The Move Toward Integrated Software

COMPUTE!'s GAZETTE

$2.95
January 1985
Issue 19, Vol. 3, No. 1
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For Owners And Users Of **Commodore VIC-20**™ And **64**™ Personal Computers

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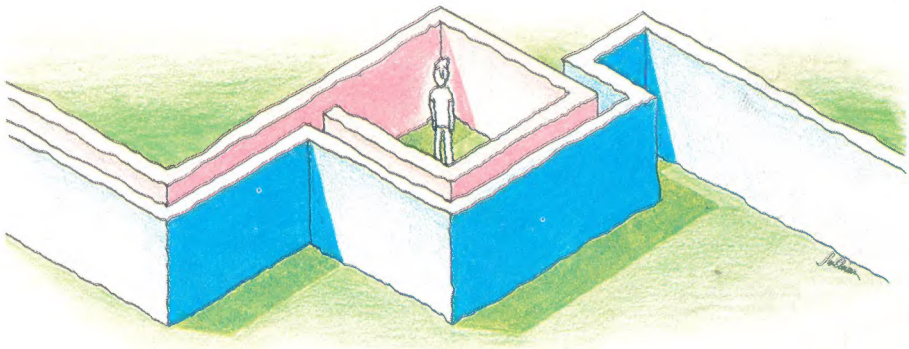

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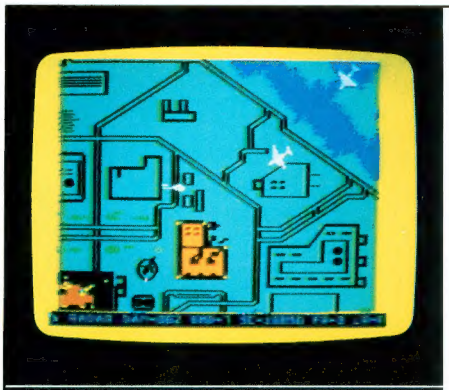
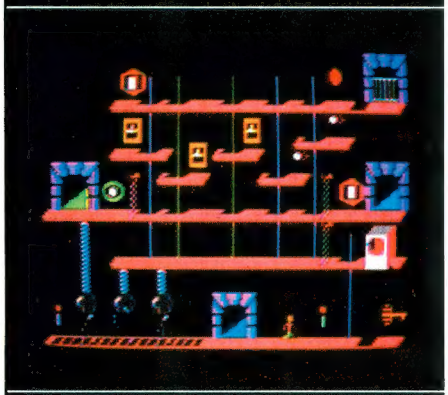


RAID ON BUNGELING BAY™

When you shopped for a computer, you wanted one with a lot of intelligence. This game may lead you to regret that choice, as your friendly little computer becomes the brains behind the most fantastic enemy you will ever face: The War Machine.

A monstrous artificial intelligence directs an endless army of self-replicating robot weapons and a complex of factories hidden on six heavily defended islands. Even as you strike at one island, robots beyond your field of vision continue to multiply...to repair the damage you've done...to attack and destroy.

Before all of Humankind is crushed beneath the Bungeling Empire's iron heel, one faint hope remains: you in your helicraft.

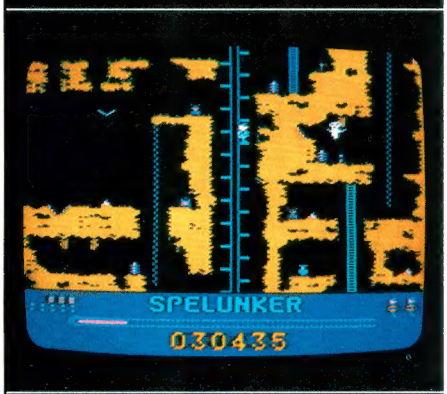


THE CASTLES OF DOCTOR CREEP™

Ever dream that you were locked in a haunted castle, wandering blindly through darkened corridors, never knowing what ghastly demons await you? Then you'll feel right at home in *The Castles of Doctor Creep.*

It's a maddening maze of 13 separate castles, more than 200 rooms in all. Sinister surprises await you behind every door: mummies and monsters, forcefields and death rays, trap doors and dead—*very* dead—ends. Remember where you've been and watch where you're going...there's got to be a way out *somewhere*!

Better hurry, or you'll wind up playing a rather unpleasant role in one of Doctor Creep's experiments.

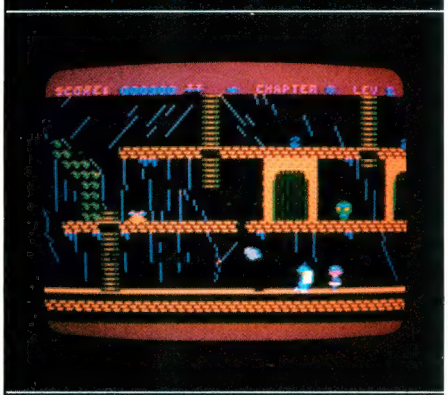


SPELUNKER™

Who knows what fabulous treasures—and unspeakable dangers—await you in the world's deepest cave? This is one game you can really get into... and into...and into.

Wander through miles of uncharted passageways, swinging on ropes and ladders, tumbling over subterranean falls and plunging to the very depths of the earth on an abandoned mine railroad. Deadly steam vents and boiling lava pits threaten you at every turn. Chattering bats and the Spirits of dead Spelunkers beg you to join them, permanently.

Let's face it: you're in deep, deep trouble.

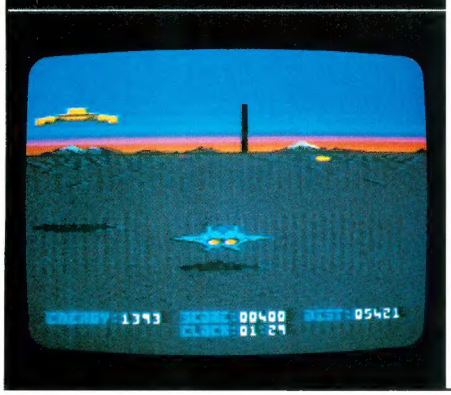


WHISTLER'S BROTHER™

You're the star of a full-fledged arcade adventure—and the big question is whether it'll turn out to be a comedy or a tragedy. That's because your co-star and beloved brother, Archaeologist Fenton Q. Fogbank, is rather absent-minded and extremely accident-prone.

As you search for priceless treasures in steaming tropical jungles, ancient cliff villages, musty old tombs and glittering crystal caverns, you control both your character and your brother. The only way to keep him on track and out of trouble is to whistle and pray that he follows you to safety.

Poison arrows, runaway boulders, fearsome frogs and mysterious mummies are only a few of the hazards that'll make you wish you weren't your brother's keeper.



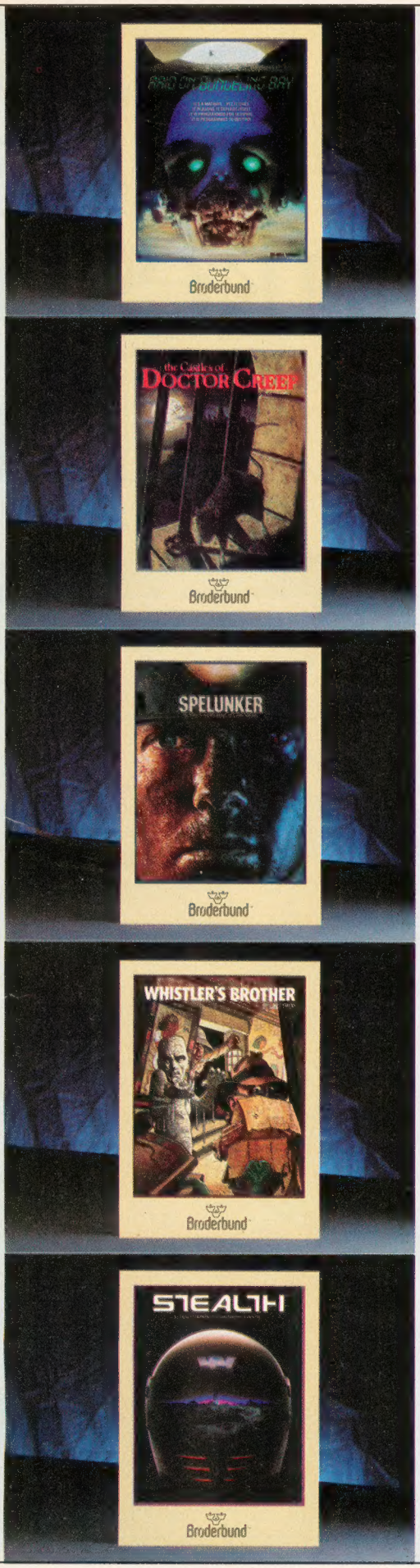
STEALTH™

You're all alone on a strange and forbidding planet. On the distant horizon, looming thousands of meters above the blasted landscape, lies your destination: The Dark Tower, home of the mysterious Council of Nine, cruel overlords of a conquered world.

You must maneuver your Stealth Starfighter through an unending assault by the Council's automated arsenal—jets and heat-seeking missiles, photon tanks and anti-aircraft batteries, vaporizing volcanoes and deadly energy fields. Outgunned and outmanned, you must press ever onward, with only your stealth to rely on.

You must reach the Tower. You must destroy it. There's no turning back.

All titles available on Commodore 64. Championship Lode Runner *also available on Apple II+, IIe, IIc.* Whistler's Brother, Spelunker *and* Stealth *also available for Atari Home Computers. Commodore 64 is a trademark of Commodore Electronics, Ltd. Apple is a trademark of Apple Computer, Inc. Atari is a trademark of Atari Corporation.*



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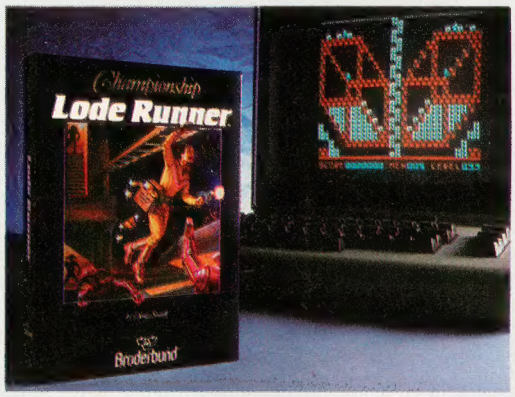

CHAMPIONSHIP LODE RUNNER™

It has come to our attention that some of you out there think you're pretty good at *Lode Runner,* 1983's best computer game. For those foolhardy few, we offer a challenge of a higher order: *Championship Lode Runner.*

With fifty fiendish Treasury Chambers: more intricate, more elaborate, more insidious than anything you've seen before. You'll need lots of skill, lots of smarts, and every ounce of your lode-running experience to have any hope at all of survival.

And if you haven't yet paid your dues on the original *Lode Runner,* don't even think of attempting this championship round.

Broderbund™

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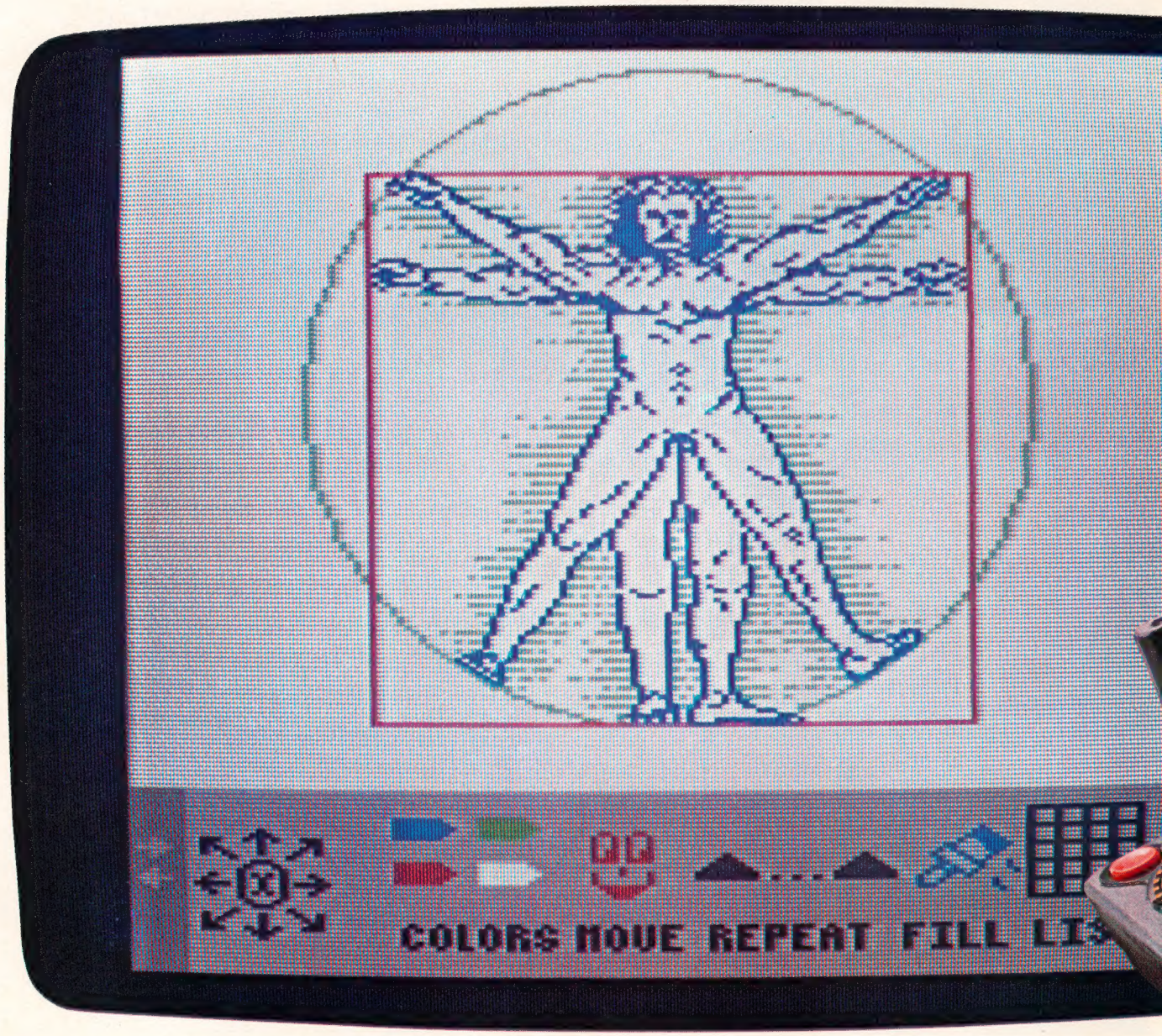

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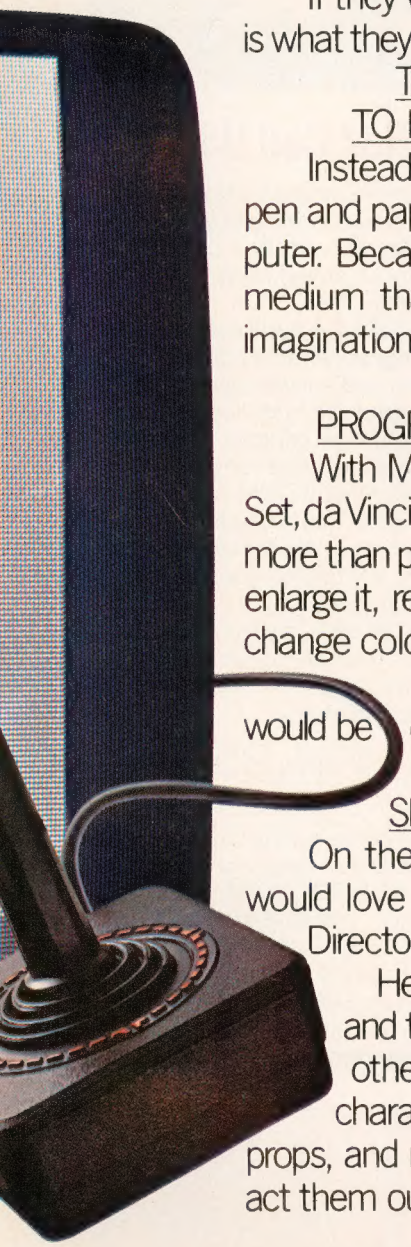


If they were starting out today, this is what they could start with. Pixelwerks.

THE OTHER WAY TO DRAW AND WRITE

Instead of a brush and canvas, a pen and paper, they'd create on a computer. Because Pixelwerks is the first medium that can keep up with their imaginations.

MR. PIXEL'S PROGRAMMING PAINT SET

With Mr. Pixel's Programming Paint Set, da Vinci (or any 8-year old) could do more than paint a picture. He could also enlarge it, repeat it, move it around, and change colors. Instantly.

And at the same time, he would be developing his programming skills. Painlessly.

SHOW DIRECTOR

On the other hand, Shakespeare would love to play around with Show Director.

He'd use it to create plots and think up one scene after another, and he'd get a big cast of characters, lots of backgrounds, props, and musical sound effects to act them out.

BANK STREET STORYBOOK

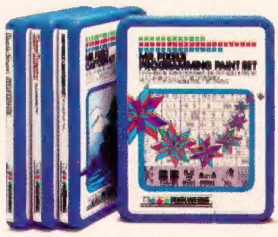
Dickens wouldn't be able to keep his hands off Bank Street StoryBook by George Brackett.

Not only could he write his own story, but he could also illustrate the scenes and characters he sees in his mind.

MR. PIXEL'S CARTOON KIT

Maybe Al Capp wouldn't be satisfied with cartoons that just sit on the page after he tried Mr. Pixel's Cartoon Kit. Because he could make his cartoons come to life by animating them. His characters could move around, and even react to each other.

Every kid has a touch of creative genius buried inside. The job of Pixelwerks is to bring it out, with more features, more options and more flexibility than other programs.



In short, we supply the tools. Kids supply the imagination.

PIXELWERKS

Pixelwerks is published by Mindscape, Inc., 3444 Dundee Road, Northbrook, IL 60062. For more information, call 1-800-221-9884. In Illinois 1-800-942-7315.

Quick.

How many plates can the Juggler juggle?

Chinese Juggler

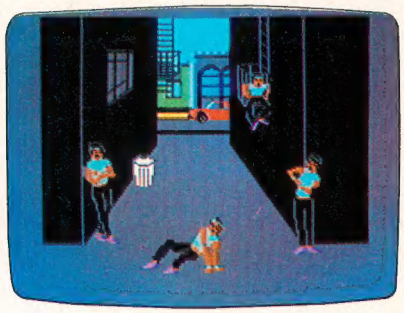
That depends on you. You are the Juggler and your act is the delicate art of plate spinning. Yours will be a tough act to follow if you succeed in matching colors and spinning plates on all 8 poles at the same time.

As your skill increases, so does the pace and the challenge of the game. You must act with speed and precision or the curtain will come down and your act will be all washed up!

Chinese Juggler is a refreshing departure from the usual shoot-em-ups and strategy games. It's fun, fast-paced and will delight players of any age. For Commodore 64. New from Creative Software.

$24.95

How do you moonwalk, snake and tut?



Break Street

You'll soon become a break dancing expert with our latest bestseller, Break Street. Now that combination of gymnastics, mime, funk, and just plain show-off, leaves the sidewalks and comes home to your Commodore 64.

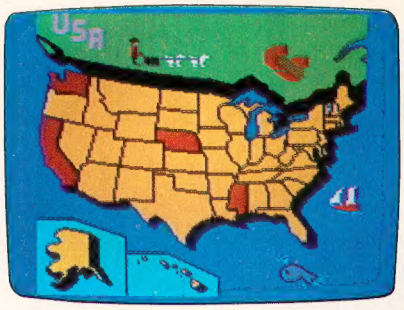
Individual play guides you through the footwork of moonwalk, backspin, windmill, tut, and the rest of those sidewalk moves. Slow motion and lively musical accompaniment help you perform each move step by step. String together a whole series of moves and record them for future replay.

Catch the beat of the street with Break Street. For individual or team play. New from Creative Software.

$24.95

The answers are at your finger tips.

What's the capital of Alaska?



Roll Call USA

Do you know? Get ready to outwit your family and friends with Roll Call USA's fun facts on states,capitals and major industries.

Roll Call USA combines history and geography facts into a colorful question and answer game that challenges your knowledge of the 50 states, their capitals, major industries and statehood dates.

Feel confident? Drill yourself with a Flash Test. The game is speeded up, so think fast. Your answers are tallied up at the end for a final score.

Roll Call USA, a game of USA trivia for team or individual play. For Commodore 64. New from Creative Software.

$14.95

Call and order today! Use your Visa, MasterCard or personal check. Toll Free **1-800-331-7990** (outside California), **1-800-448-1001** (in California), or **1-408-745-1655.** MONEY BACK GUARANTEE. If not completely satisfied, return within 10 days for full refund.

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* =General, **V**=VIC-20, **64**=Commodore 64, +**4**=Plus/4, **16**=Commodore 16.

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THE EDITOR'S *notes*

Whither Commodore?

By now, or perhaps *not* by now, the Plus/4 and the 16 are making their long awaited debut across the retail frontiers of America. From what we can tell so far, this debut may well be an "emperor's new clothes" phenomena, with lots of debut, and not much else. Our old friend Jim Dijon, a Commodore marketeer and survivor, was recently quoted as suggesting that if the marketplace so wished, Commodore would be happy to make the 16 and Plus series compatible with the 64. One would hope the marketplace wouldn't have to wish too hard for such compatibility, what with at least a million or so 64s out there. On top of all this wishing, Commodore has somehow managed to devise an entirely unique plug for the Plus/4, thus insuring that existing peripherals won't be compatible.

Why do we feel that we've written this editorial seventeen times or so in the last five years?

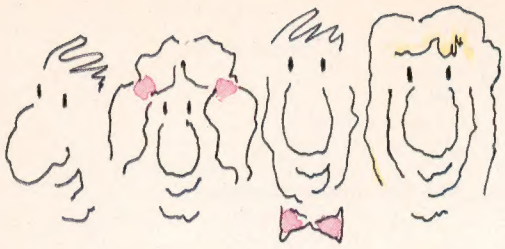
Hope?!?

Rumor now has it that perhaps the 16 and Plus/4 are already being "de-emphasized," giving way in turn to the even newer 128 series. Ah. More memory? Yes. Software compatible? Yes. Peripheral compatible? Yes. Plus, some new peripherals, notably a dual disk drive . . . now those are pluses we can applaud. Lest we sound totally like sour grapes this issue, we'll remind our loyal readers that this is the company that has been responsible for much of the home computer industry, and we feel, correctly we think, that they have a continuing obligation to help drive and nurture it. Commodore's potential success with the Lorraine is something we're anxiously awaiting.

We've seen successive iterations through hardware and software "breakthroughs" in this industry, and we think the Lorraine has the potential for achieving several breakthroughs at once. The significant power this computer can cost-effectively bring to the marketplace will, in our opinion, define a new benchmark for price and performance in the entire industry. No one in the market was selling a color computer with reasonable memory for less than $1000 until Commodore broke the price and hardware constraint barriers. With the power of Lorraine: 128K RAM, built-in drive, 4096 colors, 68000 microprocessor, multicolored sprites, maximum hi-resolution of 640 × 200 pixels . . . the list goes on, including built-in speech synthesis and built-in modem. These are only highlights of the features of the Lorraine prototype demonstrated by Amiga before they sold their company to Commodore. This unit was preproduction priced at $1200–$1400.

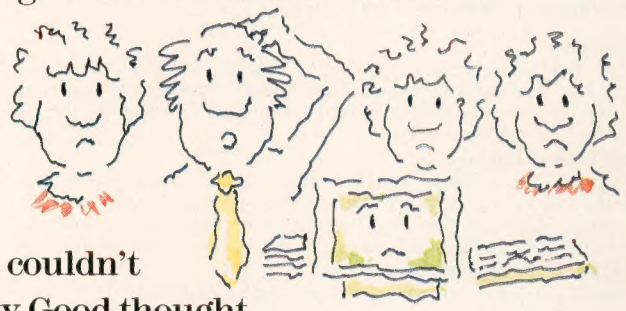
Of course, Commodore may change some of these features before product introduction. Pricing will probably change as well. But we've seen enough to call the Lorraine a significant price/performance breakthrough, and we think it will spark a new plateau in the industry. We expect to learn more about the configuration of the "real" system at this month's Consumer Electronics Show in Las Vegas. We'll keep you posted.

Robert Lock

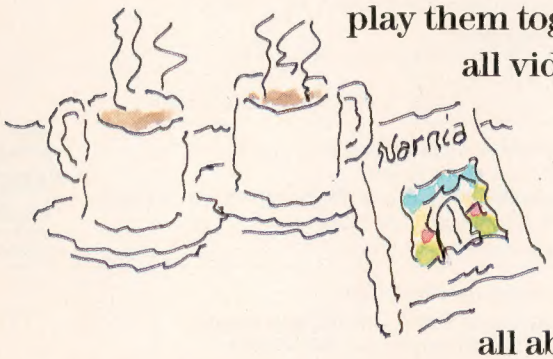


How the Nice Family Helped Their Good Neighbors

It was after Christmas. The Nice family was still enjoying all the wonderful presents they received from one another. But next door, at the home of their Good neighbors, things weren't all that wonderful.

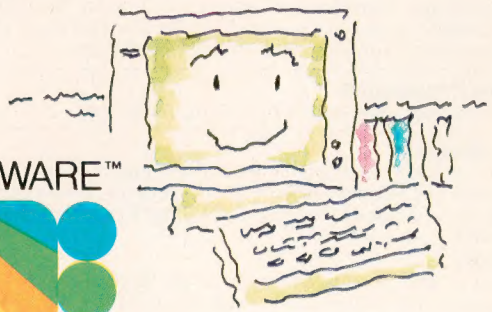


You see, Mr. and Mrs. Good (Harry and Betty) had given a new home computer to their twins (Kim and Kerry). It was a very good gift, but they didn't know what to do with it. Harry Good thought video games were bad because the twins couldn't play them together. Betty Good thought all video games were too violent. And the Good twins thought anything *but* games were boring!



Then, one day, Betty Good was talking to Janet Nice over morning coffee. "We have this wonderful computer, and nothing to do with it!" moaned Betty. Janet just smiled, and told Betty all about *Adventures In Narnia*, a new series of LifeWare™ computer games from Word Publishing. These games are the first ones the whole family can share. And they're based on the famous stories of Narnia by C.S. Lewis, which teach lasting values good for *everyone* to learn. Well, the Goods rushed out and bought *Narnia* and *DawnTreader*. And now the Good twins play with their new computer all the time. Harry and Betty Good play with them, too. And they all agree *Adventures In Narnia* are the best games they could have. Maybe they'd be good for your family, too!

Narnia and *DawnTreader* are available at computer specialty stores and all fine bookstores. All *Adventures In Narnia* games are compatible with Apple II series® and Commodore 64™ home computers.



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GAZETTE FEEDBACK

EDITORS AND READERS

Do you have a question or a problem? Have you discovered something that could help other VIC-20 and Commodore 64 users? Do you have a comment about something you've read in COMPUTE!'s GAZETTE? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403.

Note: In the November "Buyer's Guide To Modems," the Mitey Mo Modem was listed as being RS-232 compatible. It is actually Commodore 64 compatible and plugs directly into the user port. It does not require an extra interface.

Where's The Printer?

Several readers have written asking where they can get Okidata's new color printer, the Okimate 10 (see the Consumer Electronics Show report in the September GAZETTE *for details). According to an Okidata representative, there had been problems with the supporting software. As this issue went to press, we received an Okimate 10. It will be covered next month in Charles Brannon's "Horizons" column.*

Warning Light

Could you write a short set of directions that explain what to do when the red light on a disk drive begins blinking? Also, why does the manual say (on page 8) "Never remove the diskette when the green drive light is on."? The green light comes on when the drive is turned on and stays on.

Evelyn M. Arnold

The green light indicates the disk drive is turned on. You can safely insert and remove disks while the green light is on. In fact, you should wait until the drive is on before inserting a disk. Don't turn it on with a disk inside; it's possible the initial surge of power will scramble some data on the disk.

The latest editions of the 1541 manual have been corrected to say "never remove the diskette while the red light is on." This is the proper advice.

When you load or save a program to disk, the red light comes on to indicate disk activity. If you open a data file, the red light will stay on until the file is closed. In these cases, there's nothing to worry about. The red light means the drive is doing its job.

But use an incorrect disk command and the red light will begin flashing rapidly, signaling a disk error.

If you type in a BASIC command incorrectly or make some other programming error, your computer will respond with ?SYNTAX ERROR or another such message. If you encounter a disk error, however, there is often no warning on the screen to alert you that something has gone awry, but the red light on the drive will flash.

The 1541 disk drive is an intelligent device, containing its own microprocessor, ROM, and RAM. It also has error-handling routines in ROM similar to the routines in the VIC and 64. A tape drive doesn't have its own microprocessor, so messages about tape errors are built into the computer. But disk error messages are found in the disk drive. When the light flashes, you can read the error message. But first you must instruct the computer to ask the disk drive what the problem is.

You must always communicate with the disk drive over one of the 16 available channels. Channel 15 is reserved as the command channel. *It's used for formatting disks, scratching files, and various other tasks. It is also the channel for reading disk errors.*

To find out why the red light is flashing, enter this short program:

```
10 OPEN15,8,15
20 INPUT#15,E,E$,T,S
30 CLOSE15
40 PRINTE;E$;T;S
```

Line 10 OPENs channel 15, the command channel. Line 20 INPUTs the information concerning the error from the disk drive into the 64. E is the number of the error, E$ is a short description in text of the error, T is the track number on which the error occurred, and S is the sector number of that track. Since INPUT# is not allowed in immediate mode, you must read the error from within a program.

Normally, this program will display:

0 OK 0 0

To generate an error condition, remove your disk from the drive, turn the drive off, then back on again and enter:

LOAD"*",8

The disk drive will whir and clatter, then stop, with the red light flashing. Now run the error channel program, and the computer screen will display:

21 READ ERROR 18 0

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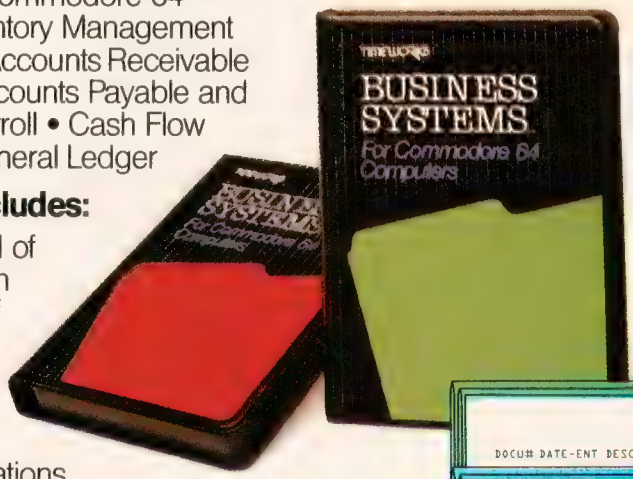

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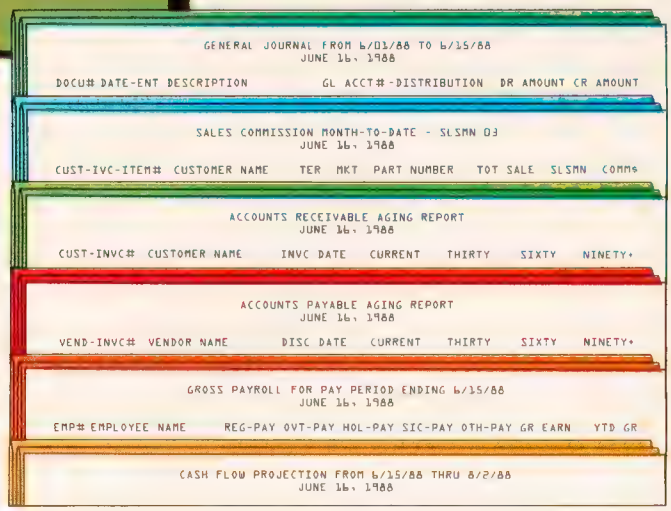
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The number 21 indicates the type of error encountered, READ ERROR is a brief description of the error, 18 is the track which the disk drive was attempting to read, and 0 is the sector which the disk drive was attempting to read. Since no disk was in the drive, there was nothing to read, causing a READ ERROR.

In most cases you don't need to know the track and sector where the error happened, so you can leave off the T and S. And you can get the error-reading routine down to a single line: 10 OPEN15,8,15: INPUT#15,E,E$: PRINTE;E$: CLOSE15.

A handy utility is included on the disk which is packaged with your disk drive, the DOS Wedge. Load and run the DOS Wedge loader program, then you can read the error channel by just pressing the @ or > key on the computer.

For information about the errors likely to be encountered while using your disk drive, consult your 1541 User's Manual.

VIC Expansion Memory

When programs in your magazine point out that at least 3K or 8K expansion is needed, does that mean that these programs will run on a 16K VIC without making any changes in the POKEs?

N. C. Barrows

BASIC programs with no POKEs which work with 3K or 8K will run fine with 16K. If a program contains POKEs to screen or color memory, however, it may work only with a specified amount of expansion memory. This is because the location of screen and color memory changes as memory is added.

There are three possible memory configurations depending on the amount of memory added: unexpanded, 3K expansion, and 8K or more expansion (this third category includes 16K and 24K). Using 3K expansion moves the start of BASIC lower by 3K. Adding at least 8K expansion memory moves the BASIC program area, screen memory, and color memory. When 8K or more is added, BASIC can't use the 3K expansion area. Also, BASIC can't use any expansion memory above 24K. Expansion memory not used by BASIC can be used for machine language programs.

The key phrase in this case is "at least." Any program which runs on a VIC with 8K will also run with 16K or 24K. That's why we usually say "at least 8K" for VIC programs.

The following table gives the starting addresses for BASIC, screen memory, and color memory for any amount of expansion.

Expansion	BASIC	Screen	Color
none	4097	7680	38400
3K	1025	7680	38400
8K+	4609	4096	37888

Turn It Off, We're Trying To Watch TV

When I turn on my Commodore 64 and the television nearby is tuned to channel four, diagonal lines appear on the screen. If anybody is watching TV, they complain they can't see the picture. I switched the computer to channel three and the same problem occurs. How can I solve this problem?

Michael Miller

In order to get a picture onto a television screen, a computer sends out a television signal. The RF modulator in your 64 acts like a miniature television station, with limited range.

The problem you're having is that the signal is a little too strong. The best solution is to shorten the cord which goes from the 64 to the TV. If you don't want to cut it yourself, you can probably find one with the appropriate connectors at a local electronics store. A shorter cord allows less of the TV signal to leak out. You might also wrap the switchbox (the one labeled TV/Computer) with aluminum foil.

Here are some other things to try: Move the computer as far as possible from the family television, or to another room. Try using different electrical outlets, preferably on different lines—one for the television, another for the computer. Or put something metal, like a metal bookshelf, between your 64 and TV to act as a shield.

Before a computer can be sold in the U.S., it has to be tested by the FCC for its effective radio/TV interference. If you look on the inside front cover of the manual which came in the box with your VIC or 64, you'll see the statement of FCC certification. It also lists a pamphlet about solving interference problems, which is available from the Government Printing Office.

Special Effects On The 64?

Is there any way I can turn my 64 into a special effects generator? I want to connect one or more VCRs as inputs to make split screens, borders, and windows, combining the video picture with a text overlay.

Mike Winderman

The signal sent out by a VIC or 64 is TV-compatible, which means it is also VCR-compatible. There are two ways to hook up your computer to a VCR. If the VCR has an input jack for cable TV, you should have received a small 75/300 ohm converter with the VCR (so you can attach an antenna in place of the cable). Disconnect the computer cable from the two antenna screws in back of the television and attach the two prongs from the switchbox to the 75/300 ohm converter. Then plug it into the VCR.

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Most VCRs also have two other inputs: one for audio in, one for video in. If you have a monitor cable (which plugs into the front of a 1701 or 1702 monitor), you can plug the two wires into the back of your VCR, audio to audio, video to video. This results in a better picture than the first method.

Why connect your computer to a VCR? There are several reasons. If you don't have a printer, you can list a program while the VCR is recording. You then use reverse, fast forward, and freeze to look at the program listing. Or use graphics and color screens (generated by the computer) as titles and credits in homemade videos. And if your telecommunications software cannot download, you can record conversations or electronic mail to look at later (although you still can't download programs).

Recording the computer's video output, while using a separate microphone for audio could be useful in a class on programming.

And finally, you might record a videogame, so you can later study your moves and the computer's responses. Recording the score would also be a way to prove to friends that you really got five million points in your favorite action game.

So it is possible to put the audio and video signals from a VIC or 64 onto videotape. Unfortunately, the special effects you mention, windows and text overlays, require a specialized video-editing machine. You can't create them with just your 64.

If you have both a VCR and a color monitor, there's another possibility you might not have considered. One of our editors has his Commodore 1702 monitor hooked up to a VCR. The 1701 and 1702 have a much higher resolution picture than a color television in the same price range, but they don't have tuners. The VCR does have a channel selector, and many have video and audio output *jacks (as well as inputs). By routing these signals to the monitor, he gets much sharper, clearer pictures than are possible on a conventional television. Thus, when he's not using the monitor to display computer programs, he can use it to watch his favorite television programs.*

Elusive Characters

I've run into a problem typing programs from your magazine. The answer is not listed in "How To Type In COMPUTE!'s GAZETTE Programs." How do you type {SHIFT-SPACE} or {2 SHIFT-SPACE}?

James Litrell

Commodore computers have two different space characters. You get the first by simply pressing the space bar. The second, a SHIFT-SPACE, is entered by holding down the SHIFT key while you type a space. Think of it as a "capital space." A regular space has an ASCII value of 32, a SHIFTed space is ASCII 160. And if you PEEK the screen, they have two different values, 32 or 96.

As explained in "How To Type In COMPUTE!'s GAZETTE *Programs" in the back of the* GAZETTE, *any time you see a number X preceding a special character in brackets, it means to type that character X number of times. So {2 SHIFT-SPACE} means you should type two SHIFTed spaces—hold down the SHIFT key and press the space bar twice.*

There are two reasons why a SHIFTed space might appear in a listing. If the program runs in upper-/lowercase mode (as opposed to uppercase/graphics) and a message contains all capital letters, it's easiest to type it with the SHIFT LOCK key down. You could type the message "PRESS ANY KEY" with the SHIFT LOCK key engaged, and the spaces between the words would actually be capital spaces.

Second, if a program uses redefined characters, there might be one new shape for a space and a different shape for a SHIFTed space.

In the first case (uppercase messages) it wouldn't matter much which space character you used. They look the same on the screen. In the second (custom characters), it makes a big difference which character is which.

One other character in our listings which gives some readers trouble is the left-arrow, just above the CTRL key, in the upper left-hand corner of the keyboard. The printer used for GAZETTE *listings does not have this character, so when it appears in a program, it's listed as a less-than sign with a hyphen through the middle. It looks a little like the tracks of a chicken walking through snow.*

Relocatable Machine Language

I'm a fanatic about writing machine language programs which are totally relocatable within RAM. As such, I tend to rely on relative addressing as much as possible, using multiple branches to make longer jumps. As of yet, I have not found a method of branching to subroutines which has worked satisfactorily. I'd like to know if it's possible to access the program counter so that its contents may be pushed onto the stack prior to a relative jump to a routine which ends with the RTS instruction.

Donald E. Cook

Certainly there are advantages to relocatable machine language, but what you're proposing is fairly advanced. The longer your ML program, the more difficult it becomes to make it relocatable.

The 6502/6510 gives a programmer no direct access to the program counter. Only instructions like JMP, JSR, RTS, and branches can indirectly change the program counter. Since you are branching to a subroutine, you must have a way to create a return address on the stack so that when the sub-

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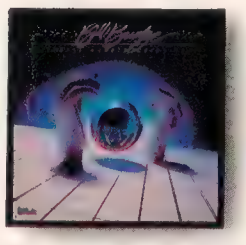

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routine hits the RTS, execution is returned just after the instruction that called the subroutine.

There is a trick you can use to deduce the current value of the program counter. When you jump to a subroutine with JSR, the address of the next instruction is pushed onto the stack high byte first, then low byte. The actual value is one less than the address of the next instruction. RTS pulls the two bytes off the stack, adds 1 to the value, then stores this in the program counter, effectively returning from the subroutine.

Since JSR stores this address on the stack, the address can be examined in a subroutine with PLA. This small subroutine performs the "where am I?" task. After the bytes are examined, they have to be put back onto the stack so that the "where am I?" subroutine can return to the main program.

```
WAI   PLA       ;get low byte of return address-1
      TAX       ;save it
      PLA       ;get high byte of return address-1
      TAY       ;save it
      PHA       ;put high byte back on stack
      TXA       ;get low byte back into the accumulator
      PHA       ;put it back so address is restored
      SEC
      SBC #2    ;get address of the JSR opcode
      TAX       ;low byte is in X
      TYA       ;get high byte
      SBC #0    ;adjust for carry
      TAY       ;high byte back in Y
      RTS       ;return with address in X and Y
```

When you want to know the value of the program counter, JSR WAI. The WAI subroutine itself cannot be relocatable, of course, since your program must know the address of WAI in order to JSR to it. Once you have this current address, you can then create a return address for the instruction following a branch to a subroutine. Remember that the return address is the actual address minus one. Push it onto the stack high byte first, then low byte. You can then branch to a subroutine, and RTS will return execution as you desire. This can be extremely cumbersome, though.

The "Where am I?" technique can also be used to calculate the address of a data table. You must know the offset between the address of the JSR WAI and the location of the data table. You add in the value returned by WAI, and you have the absolute address of the data table. Again, though, the work needed to set up relocatable code is hardly worth the effort. A relocating loader that moves and adjusts an absolute program can often be far more useful. Some assemblers can generate object code that can be loaded anywhere by a relocating loader. Even though most advanced programmers know about this theoretical way to achieve true relocatability, few programmers consider it worthwhile. You'll just have to wait until home computers use a microprocessor like the 68000, which supports full relocatable code (and then some).

Locating A Program On Tape

I have a tape problem. Some of your programs come in two parts. I type in Program 1 and save it, then type in Program 2 and save it. Then I discover an error in Program 2. How should I fix it? If I load it, debug it, and save it back to tape, it will be one program away from where it should be. The tape will have Program 1, Program 2 (with errors), and Program 2 (corrected). Should I look at the tape counter? Or is there a better way?

John C. Onken

When you're trying to position a tape to a specific location, you can use the tape counter. But it is not entirely accurate, and you may encounter problems if you accidentally record over the end of a previous program.

Another solution is to load Program 1, save it at the beginning of a brand new tape, followed by the correct version of Program 2. The disadvantage, of course, is that it's time-consuming to load and save two programs, especially if you have to do it more than once.

The best answer is to use the VERIFY command. The purpose of VERIFY is to make sure that a program has been saved correctly. But it also positions the tape just past the verified program.

So, after you've corrected Program 2, rewind the tape and enter VERIFY. The computer will try to verify the first program on the tape (Program 1). Program 2 (in memory) won't match up and you'll see ?VERIFY ERROR on the screen. Ignore the error message. The tape will have advanced past Program 1 to the place you want to put Program 2. You can now save it.

VERIFY can also be used to find out which programs are on a specific tape, without disturbing the program in memory. Make up a name, one that you're certain has not been used, like QWERT1111 and try to verify it. Type VERIFY"QWERT1111" and the computer will respond SEARCHING FOR QWERT1111, followed by FOUND PROGRAMNAME (or whatever the first program is called). It will keep searching for the nonexistent program name, while listing each of the programs it has found on the tape.

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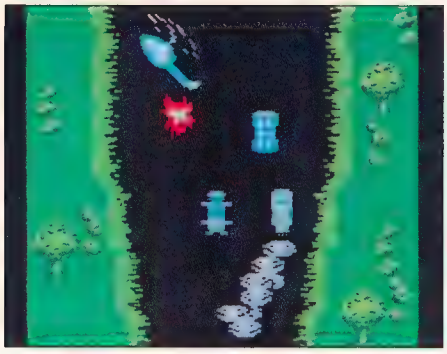

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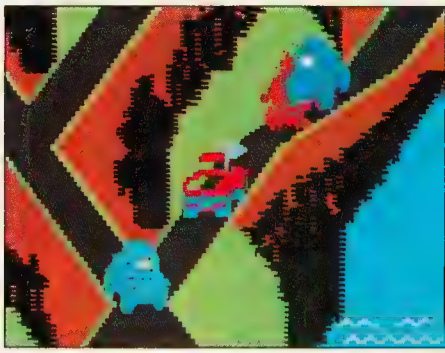
Are you fast enough to play Tapper? If you have to ask, you probably already know the answer.



Bally Midway's Up 'N Down by Sega. In this game, a crash is no accident.

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Crashing, bashing Up 'N Down. It's one smash hit that really is a smash.

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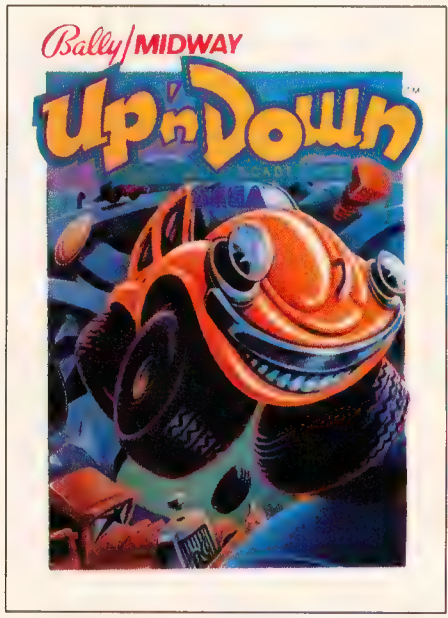


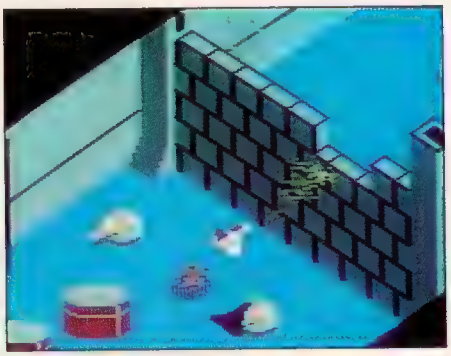
#1 Arcade Hit, *Play Meter* Conversions Poll, 8/1/84.

WERE SUCH BIG HITS, THEM HOME.

Sega's Congo Bongo rocked the home game world when it shot up to Number 3 on the Billboard chart this spring.

And now it's available for even more home systems. So check the chart and get ready for jungle action. You'll pursue the mighty ape Congo up Monkey Mountain and across the Mighty River. Do battle with dangerous jungle creatures. Ride hippos, dodge charging rhinos and try to avoid becoming a snack for a man-eating fish.

Congo Bongo. It's fast and it's fun. But be careful. It's a jungle in there.



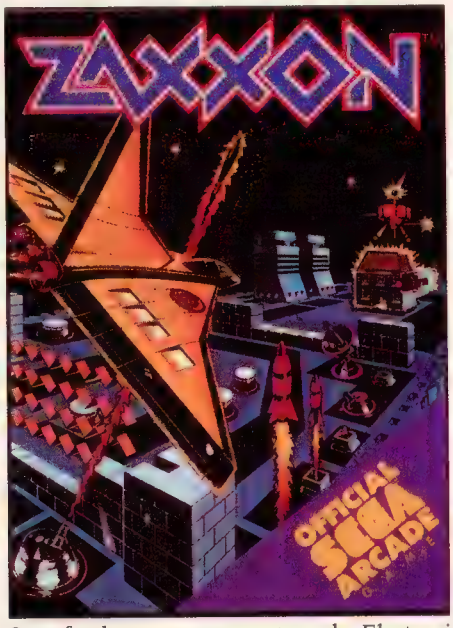
Sega's Zaxxon. If you haven't played Zaxxon, you must have been living on another planet for the past few years.

And now the ultimate space combat game is available for even more home systems. You'll pilot a space fighter through force fields and enemy fire on your way to do battle with the mighty Zaxxon robot. Countless others have gone before you in this Hall of Fame game. But this time your life is in your own hands.

Zaxxon killed them in the arcades. But compared to what it will do to you at home, that was child's play.

	SPY HUNTER	TAPPER	UP 'N DOWN	CONGO BONGO	ZAXXON
Atari 2600 cartridge	NEW	NEW	NEW	✓	✓
Atari 5200 cartridge				✓	NEW
Atari Computers* cartridge	NEW	NEW	NEW	✓	NEW
Atari Computers† diskette	✓ NEW	✓ NEW	✓ NEW		✓
ColecoVision & ADAM cartridge	✓ NEW	✓ NEW	NEW	✓ NEW	✓
Commodore 64 cartridge	✓ NEW	✓ NEW	✓ NEW		NEW
Commodore 64 diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Apple II, IIe, IIc diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
IBM PC diskette	✓ NEW	✓ ** NEW	✓ NEW	✓ ** NEW	✓ ** NEW

Arcade and Home Smash. Hit #3 on *Billboard* magazine's Top Video Games survey.



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SCRATCH command and entering ? as the name. This also scratches all files with a single character name, and care should be taken to rename or duplicate them before scratching the "," file.

Fred Q. Hickam

You're right. Many readers wrote to tell us of this solution. The question mark is described in the 1541 User's Manual *as a "wild card," which can stand for any other character. So, if you type LOAD "P?N",8 the computer will load the first program with a name which fits that pattern: PEN, PIN, PAN, P9N, etc.*

For readers who are new to disk commands, here's a quick explanation of how you scratch and rename:

*OPEN15,8,15,"S0:*filename*":CLOSE15 scratches a file from disk. And with the question-mark wild card, OPEN15,8,15,"S0:?":CLOSE15 will scratch all files with one-letter names. If you have a file called "Q" you don't want scratched, you can rename it with OPEN15,8,15,"R0:*newname*=Q" :CLOSE15 before scratching the one-letter files.*

Chained Programs

What statement is used in a program to call another program? What this command should do is load another program and run it automatically.

Sandra Rodriguez

Is there a way to add the BASIC line SYS XXXXX to machine language programs that start at 49152 or elsewhere (so I could type RUN without having to remember the SYS number)?

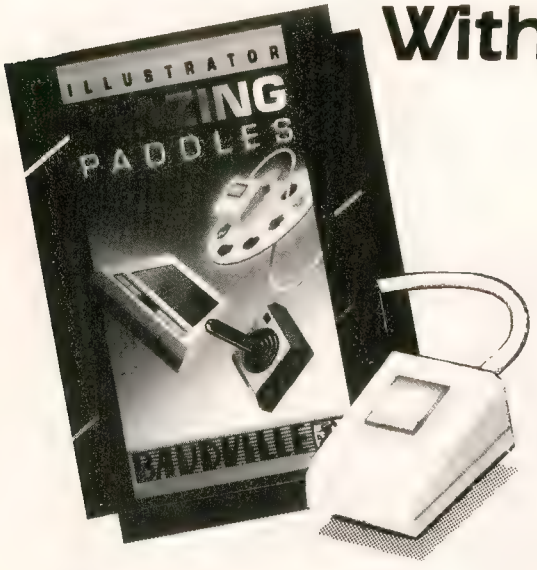
S. J. Carpenter

To load a BASIC program from within another BASIC program, simply put the LOAD command in a line inside the first program. When you load from direct mode, the program goes into memory but does not automatically run. But if you load from inside a program, it loads and runs.

Since BASIC programs always load into the beginning of memory, the second program will overwrite the first. Variables may be erased, depending on how long the programs are. If the first is larger, all numeric variables will be available for use in the second program. String variables are passed to the second program only if they are dynamic. To be sure they make it, add a null string to the end of each string variable. Instead of A$="HELLO", use A$="HELLO" + "" to force the computer to store the string in high memory.

If the second program is larger, all variables will be lost when it is called by the first.

You can load a machine language program from a BASIC program, but a small problem must be overcome. Remember that loading from within a program automatically runs the second program. But something unexpected happens if you try



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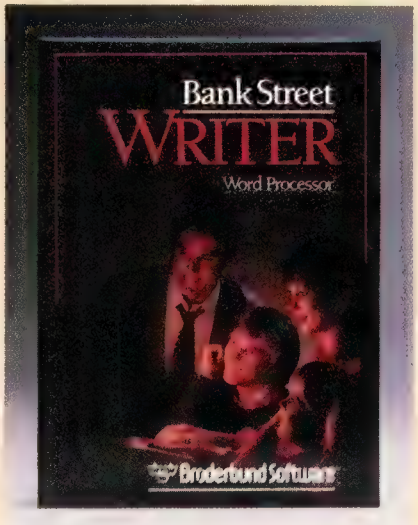

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something like this:

```
10 LOAD "MLGAME",8,1
20 SYS 49152
```

Tape users should change the 8 in line 10 to a 1. The program MLGAME loads into its proper place in memory, but then the computer tries to run the program in BASIC memory. So it loads the program again (and again and again and again). It never reaches line 20.

Variables are kept intact, so you can make a small change:

```
10 IF L=0 THEN L=1: LOAD "MLGAME",8,1
20 SYS 49152
```

The first time through, the variable L equals 0, so the game is loaded. After the LOAD, the program is run again, but this time L is 1, so it skips to line 20, which activates the ML program.

You can't really add the SYS line to an ML program at 49152 (to save as one complete program) because BASIC ROM gets in the way. But you can create a short ML loader program which loads and activates the program. And you don't have to remember the SYS number, it's built into the loader.

To load a program from within an ML program, simply call the three Kernal routines SETLFS, SETNAM, and LOAD. Details about these and other Kernal routines are in the Programmer's Reference Guide.

An Equivalent POKE?

On the VIC-20 there is a POKE 650,128. I'd like to know the equivalent of this POKE on the Commodore 64.

Ted Kalamvrezas

If you use that POKE with a VIC-20, all keys will repeat when held down. The 64 equivalent is POKE 650,128. The same POKE does the same thing.

With a few exceptions, memory locations 0–1023 have the same functions on both the VIC and 64. For example, locations 43–44 point to the beginning of BASIC program storage. The values found there will be different between the two computers, because BASIC programs start at different locations on the VIC and 64. But the two bytes serve the same function (a pointer to the beginning of the BASIC program storage area).

In any case, you can't do any harm to your computer by experimenting. If you know about a POKE for the VIC, try the same thing on a 64. The worst that could happen is the computer would lock up and you'd have to turn it off and back on.

User memory, screen and color memory, BASIC ROM, interface chips, and other locations occupy memory from 1024 to 65417. There are not a lot of similarities here. You can usually find an equivalent POKE or SYS, but the locations might be quite different.

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From 65418 to the end of memory is the Kernal Jump Table, which may contain different values on a VIC or 64. But the functions are exactly the same. The location with the hexadecimal address $FFD2, decimal 65490, is one example. It's the location for printing a character in machine language. Other Kernal routines are explained in the VIC and 64 Programmer's Reference Guides.

Entering Long Programs

I'm just beginning to type in a program. Because it is rather long, I decided to type in a little each day then save that day's work.

But when I try and go back and load the different sections together, I encounter a problem. Each successive section I load erases (loads over) the previously loaded section. Is there any way to load all the sections together without erasing the section you just loaded?

Brad McCollum

The problem you're having stems from the fact that you're treating each day's work as a separate module, or program, and saving them that way. When you reload the sections, the computer thinks they are separate programs, and loads one on top of the other.

This is supposed to happen. When you use the BASIC LOAD command, many subroutines (in BASIC and Kernal ROM) are performed to execute the LOAD. One of these is the PARSL routine at 57809 ($E1D1) in the VIC, and 57812 ($E1D4) in the 64. In a nutshell, this subroutine sets the X and Y registers with the values found in memory locations 43 and 44 which point to the start of BASIC. This is where it will load the program. This is similar to a NEW command, and it's the reason your program modules are being overwritten.

When you type in long programs in modules, do not save each one as a separate program.

After entering the first session's work, save it to tape or disk. When you wish to continue, load the latest version back into the computer, and continue to enter the program starting at the point where you left off. After the session is over, save the program (now the combined first and second sessions) to tape or disk. If you're not done yet, continue repeating the same cycle until you've finished.

Reading DATA Strings

I'm having a slight problem with DATA statements. When I run the following program, it prints "A$" instead of "HELLO"

```
10 A$="HELLO"
20 READ B$
30 PRINT B$
40 DATA A$
```

My question: Is there a way for the computer to see A$ as "HELLO" in a DATA statement after having previously defined it as such (A$="HELLO")?

Buddy Flerl

No, there's no method to do what you ask. It might help to imagine a variable as a box. On the outside you paste a label, the variable name. Inside the box is a string or numeric value. In line 20, you're reading information from a DATA statement. The name of the variable is B$ (the outside label), the contents of B$ is "A$" (a string containing two characters). As far as your computer is concerned, the string "A$" has no real connection with A$ the variable name. You can't pull a label off a variable and use it as a value, and vice versa.

Probably the best solution to your problem is to use arrays. A numeric variable can be an index to an array. In this way, one variable points to another. Try the following program:

```
10 A$(1)="HELLO"
20 READ B
30 PRINT A$(B)
40 DATA 1
```

In line 20, the value 1 is read into B from a DATA statement. That value can then be an index to the array and in line 30, "HELLO" is printed because A$(1) holds that string. If you changed the value of B, line 30 would print something else from the array.

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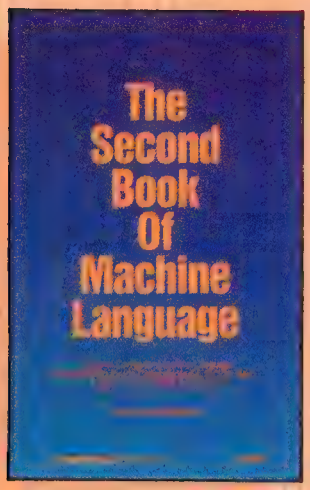

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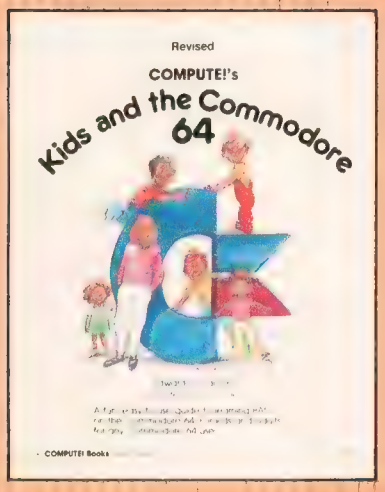

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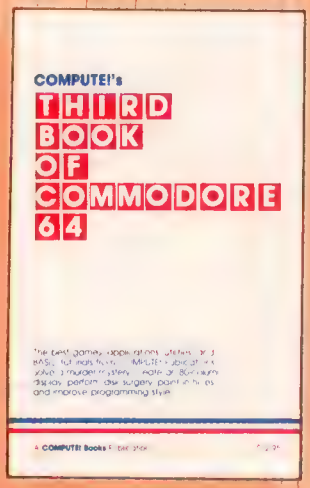

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The Move TOWARD Integrated Software

Word processing, record keeping, budgeting—you can accomplish each of these everyday tasks with your Commodore 64. Software producers are now offering new personal productivity programs which bring those separate functions together for even faster and more efficient use.

Selby Bateman, Features Editor

Imagine yourself at a desk. There are four drawers, each containing one of the following items: a typewriter, a calculator, a file box with folders, and a drawing kit of pens and markers. You take out the typewriter and begin to compose a letter. Suddenly you realize that you need a couple of records from your file box to include in the correspondence.

So, you put your typewriter in its drawer, pull out the box, find the files, take them out, return the box to its drawer, and retrieve your typewriter. A few moments later, you want several budget totals which are still stored in the calculator's memory. The cumbersome procedure begins all over again as you place the calculator on your desk, sliding the typewriter out of the way in order to use the other item. The same situation applies if you want to draw a graph of those figures.

Of course, no one actually follows such a strange and unwieldy process. Why not use all four of those items together, integrating the information and the procedures in a productive manner? When it comes to computers, that's exactly what the more powerful business machines do—accomplish multiple tasks with integrated software programs.

But for the most part, that hasn't been the case with home computers. Say you use a data base for keeping track of your stamp collection. If you then want to write a letter offering some of the stamps for sale, you'll probably have to type them in again, because your data base files aren't compatible with your word processor files. While many word processors, data bases, and spreadsheets perform their respective repertoires quite well, their acts have most often been workhorse solos rather than lilting duets or rich concertos.

While a symphony of integrated movements on the Commodore 64 has yet to be composed in the personal productivity area, that is clearly the goal toward which an increasing number of companies are headed.

One such company is Arktronics Corporation, with a new package called *Jane*.

"The idea behind *Jane* is to give professional features in the home market by making it very easy to use," says Howard E. Marks, the 22-year-old cofounder of Arktronics. *Jane* is an integrated productivity software package scheduled to be released for the Commodore 64 by the time you read this. The price is expected to be about $80. First available on the Apple IIc, the program has a Macintosh-like *icon*-based environment, using pictures and symbols to guide the user, as well as onscreen *windows* for displaying information. "*Jane* has three applications—the word processor, the spreadsheet, and the data base—on a disk. The system is on a (32K plug-in) cartridge...which boots up automatically when you turn on the computer," says Marks.

The program includes the applications disk, a data disk containing tutorial files and utilities, and the cartridge. The system is designed to work with a *mouse*—a desktop pointing device most associated with Apple's Macintosh computer—as well as the keyboard, joystick, or touch pad. Arktronics is working with several companies now as they develop mice for the Commodore 64. *Jane* also contains utilities which will configure the system for your particular printer.

The package is designed to be particularly easy to use by people new to computers, says Marks. (Hence, the name, which comes from the familiar Dick and Jane kindergarten reading characters.) "With the word processor, what you see is what you get. So you see boldface, underlining, superscripts, subscripts, and all the accents for any language on the screen. We use the full-color bitmap, the same technology as the Macintosh. You can see 80 columns on the screen, 64, or 40 columns."

> "*. . . we'll get more personal. The idea is to go toward intelligent systems that are easy to use.*"

And, importantly, the system allows you to move from one application to another. You can shift information from one window to another, thus integrating the three programs. For example, suppose you have a letter you want to write in one window and a budget in the other. By moving an electronic symbol of a hand over the typewriter and calculator icons, you can take the numbers out of the budget window and insert them anywhere you want them in the letter. By using the mouse, or one of the other input devices, you can carry out the process without touching the keyboard.

"One of the big problems that computers have today is that they're not easy to use," says Marks. "People who are afraid of computers—who have computerphobia—are not going to buy them because they are difficult."

That sentiment is echoed by David Johnson of California-based International Tri Micro. He designed and programmed the ROM-based integrated applications software which comes built into the new Commodore Plus/4 computer.

"The original concept was to provide as powerful and as friendly a work space as possible for the average user, a general-purpose work space which a large segment of the population would be able to use," he says.

Originally called *3-Plus-1* when planned for the Plus/4—to reflect the word processor, file manager, and spreadsheet, plus bar charting capability—the same programs are available on disk for the Commodore 64 in separate packages. *Your Home Office* is a word processor and spreadsheet, *The Write File* is a word processor and data base, and *Plus Graph* adds the ability to produce pie charts and variable bar and line charts from either spreadsheet or data base information.

"To make a truly software-driven machine, the idea was that these three categories represent the majority of what the first-time computer user wants to do with the machine, or will have some need to do," says Johnson. "What will happen, as we get more room [computer memory] available, is we'll get *more* personal. The idea is to go toward intelligent systems that are easy to use. That's still quite a distance on."

The more integrated a series of programs becomes, the greater the memory requirements. Packages which gobble up thousands of bytes of memory for their systems are fine for high-end business computers. But home computers with 64K must make tradeoffs. Arktronics' *Jane* attempts to solve the problem by adding a 32K cartridge to allow more capabilities. Most commercial packages for the Commodore 64 try to work within the available memory by drawing limits where necessary and by offering some integration in the most frequently used applications.

For example, while *Jane* has enough space in memory to allow you to type the equivalent of ten to twelve pages of text per file, Johnson's system in both the Plus/4 and for the 64 permits only 99 lines of text for each file. To get around that limitation, the user can link individual text files together for a printout.

There are too many personal productivity programs available for the 64 to list them all in one article. Most of the better known systems have at least some integration of features. The *Insta* series from Microsci Corporation's Cimarron Division, consists of nine

The following companies are among those with personal productivity software for the Commodore 64, with some degree of internal integration of features:

Arktronics Corporation
520 E. Liberty Street
Ann Arbor, MI 48104
(313) 769-7253
Jane, *approximately $80.00*

Arrays, Inc./Continental Software
11223 South Hindry Avenue
Los Angeles, CA 90045
(213) 410-3977
Get Rich Series, *suggested $49.95 each*

Batteries Included
186 Queen Street West
Toronto, Ontario
Canada M5V 1Z1
(416) 596-1405
Home Organizer Series, *$29.95 each*

Cardco, Inc.
313 Mathewson
Wichita, KS 67214
(316) 267-6525
Write Now *($49.95)*, Mail Now, Spell Now, File Now, Graph Now, Calc Now *(all $39.95 each)*

Commodore Computer Systems Division
1200 Wilson Drive
West Chester, PA 19380
(215) 431-9100
Magic Desk I, *approximately $30.00–$35.00*

Creative Software
230 East Caribbean Drive
Sunnyvale, CA 94089
(408) 745-1655
Creative Writer, Creative Filer, Creative Calc, *$49.95 each*

Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
(415) 571-7171
Financial Cookbook, *$50.00*

Handic Software, Inc.
520 Fellowship Road
Mt. Laurel, NJ 08054
(609) 866-1001
Word Result *($195.00)*, Calc Result Easy *($49.95)*, Calc Result Advanced *($99.95)*

International Tri Micro
1010 N. Batavia, Suite G
Orange, CA 92667
(714) 771-4038
The Write File *($49.95)*, Your Home Office *($49.95)*, Plus Graph *($39.95)*

Microsci Corporation
Cimarron Division
2158 South Hathaway Street
Santa Ana, CA 92705
(714) 662-2801
Insta-Writer *($49.95)*, Insta-Mail *($19.95)*, Insta-Calc *($39.95)*, Insta-File *($49.95)*

Prentice-Hall Home Software
P.O. Box 819
Englewood Cliffs, NJ 07632
(201) 592-2611
IMSI Home Library, *$39.95 each*

Sierra, Inc.
P.O. Box 485
Coarsegold, CA 93614
(209) 683-6858
Homeword *($69.95)*, Homeword Finance *(price not available)*, Homeword Tax *(price not available)*

Timeworks, Inc.
405 Lake Cook Road
Deerfield, IL 60015
(312) 291-9200
Word Writer *($49.95)*, Data Manager *($24.95)*, Data Manager 2 *($49.95)*, Electronic Checkbook, Money Manager *($24.95 each)*

TOTL Software, Inc.
1555 Third Avenue
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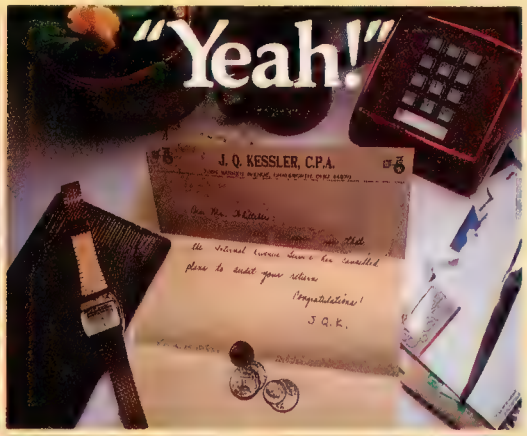

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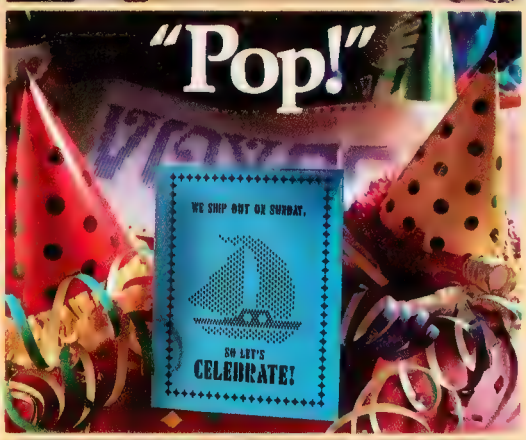

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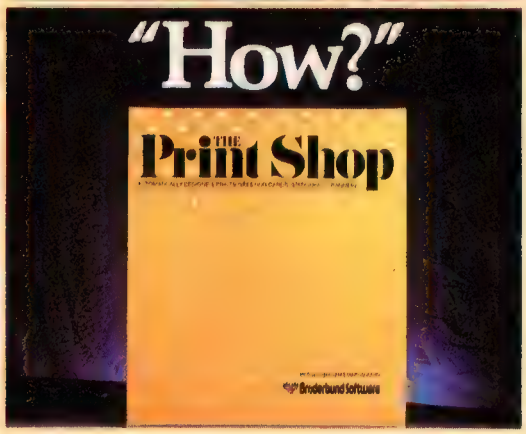

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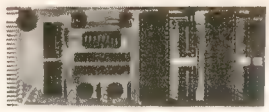

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packages for the Commodore 64 based around its *Insta-Writer* word processor on cartridge. With the word processor, you can also use the *Insta-Mail* mailing list program and the *Insta-File* data base management program. The spreadsheet and investment programs in this series can be used with the graphing package as well.

Creative Software offers three interactive packages, *Creative Writer, Creative Filer,* and *Creative Calc,* which also let you use files in an integrated manner.

Sierra's Homeword series, built around the *Homeword* word processor, includes an integrated filing system as well as a spelling checker. Other integrated packages which are scheduled for release—as this is written—include *Homeword Finance,* a home finance package; *Homeword Tax,* a tax preparation program; *Homeword Typer;* and even a *Homeword Gardener.*

Commodore's *Magic Desk I: Type and File* is a good example of how ease-of-use can be combined with limited multiple functions to provide basic applications. Using icons, or symbols, to direct the user, the program lets you type and file letters, memos, notes, and the like—a simple word processor and file manager in one.

Personal finances are well suited for integration since a common chart of accounts can be used with a variety of different programs, whether it's balancing a budget, planning future investments, buying property, or figuring interest rates.

That idea is the premise behind the new Get Rich financial series from Arrays, Inc./ Continental Software, available for the Commodore 64.

"The first module coming out, called *Get Rich: Strategies,* addresses what people do once they have discretionary dollars, those dollars people have left over once they've paid for all their necessities," says Hank Scheinberg, executive vice president.

"Integrated is too strong a word, right now. This is more like a series of books," he adds. "Once you go through *Strategies,* and you have some ideas of amortization schedules, compounding interest, inflation rates, real buying power, and the like, then the second module is *Get Rich: Real Estate Planning.*" Subsequent modules include insurance planning and retirement and estate planning, he notes. Each of the subject-specific volumes is designed to work in tandem with the original *Strategies* program, which gives the user an overall financial picture.

"These modules are set up in a question-and-answer situation. You're constantly asked questions, and the user just fills in the blanks and then picks the choice which is most beneficial," he says. "It asks questions which the uninitiated perhaps would not know enough to ask."

Whether the format is question-and-answer prompts, icon-based menus, information windows, or easy-to-remember commands, software designers are emphasizing a mix between ease of use and flexibility, that is, how easy it is to use a system versus how powerfully and flexibly it operates. That's good news for Commodore 64 owners who want productivity packages that will let them really get down to business.

In addition, software companies realize there is still a large untapped consumer market for computers. What will make people buy a computer? Perhaps the answer lies in the initial responses Hank Scheinberg has received: "The comments we're getting back are that this is a real reason to have a home computer."

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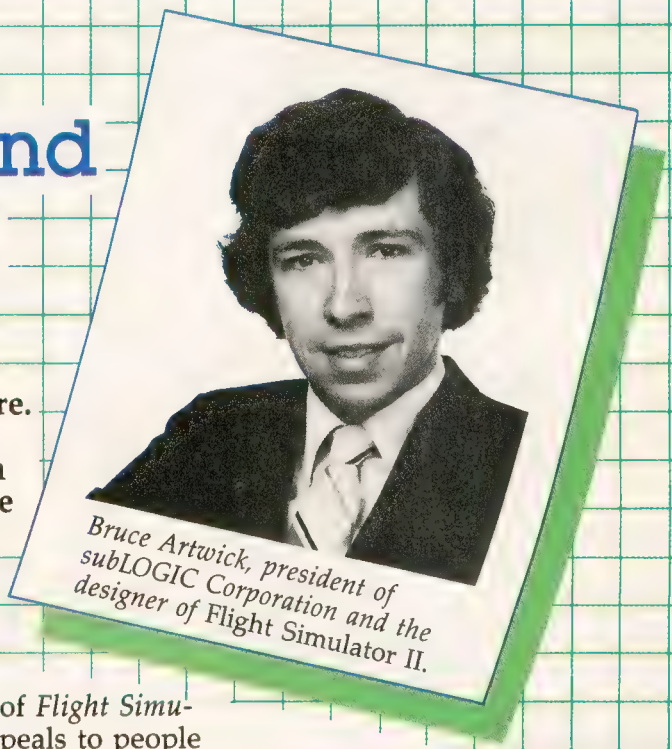
Bruce Artwick, The Designer Behind *Flight Simulator II*

Kathy Yakal, Feature Writer

There must be a lot of would-be pilots out there. *Flight Simulator II*, a microcomputer-based flight simulator, has sold a quarter of a million copies and stayed on the best-seller charts since it was introduced. Here's a look at the program and the designer.



Bruce Artwick, president of subLOGIC Corporation and the designer of Flight Simulator II.

You've seen those air disaster movies where the pilot and co-pilot are suddenly stricken with a mysterious ailment, or injured in a struggle with a hijacker. A stewardess or even a passenger must take over and fly the plane to safety.

There might have been a little less sweating in all of those movies if the substitute pilots had used *Flight Simulator II* from subLOGIC. It turns your Commodore 64 into a flight simulation lab, and puts you at the controls of a small aircraft.

The tremendous success of *Flight Simulator II* may be a bit surprising to those of us who are a bit phobic about flying. Even with our feet on the ground and hands on the keyboard, the illusion of flying can bring back memories of white-knuckled flights.

Bruce Artwick, the designer and programmer of *Flight Simulator II*, says it appeals to people for different reasons. "Some buy it just for the fun of flying around. A lot buy it because they like the graphics," he says. "There's an arcade game built into it, so some people buy it for that. And some people actually want to use it to practice flying. All of these elements—the game, flying, and nice scenery combine to attract a few from here and there."

Flying is an avocation for Bruce Artwick (he's had a pilot's license for several years), but his real interest is computer graphics. Raised in the Chicago area, Artwick went to school at the University of Illinois at Champaign-Urbana. While finishing his master's thesis there, he worked on 3-D graphics software for real flight simulators at the school's aviation research laboratory.

He took a job at Hughes Aircraft in California in the late seventies, about the time the microcomputer industry started to pick up speed. Interested in the possibilities of graphics on the new machines, Artwick started programming small 3-D graphics packages for them. He formed subLOGIC in 1977, and moved back to Illinois at the urging of his partner, Stu Moment.

His first demo program for the new Apples was a small flight simulator. "I was surprised at how successful it was. It made me realize there was a lot of consumer interest in flight simulation," says Artwick. *Flight Simulator I* for the Apple hit the bestseller charts and stayed there.

In late 1981, Artwick was

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Two views of New York City from the cockpit: the Empire State Building and Manhattan Bridge.

approached by IBM and Microsoft. Both wanted him to translate his program for a new machine that would be coming out the next year, a microcomputer with a powerful new processor that would allow him to do more than he was able to on the Apple.

He finally went with Microsoft, which published *Flight Simulator II*, an upgrade of the original Apple version, for the new IBM PC. It was so popular that people at Commodore and Apple went after him to translate it for their new computers.

"Back then, I didn't think it was possible to bring that kind of graphics performance down to the smaller machines," he says. "But we gave it a try and did the best we could."

Crunching the program down for Commodore, Apple, and Atari "...was a major project," says Artwick. "We knew that we were very tight on memory. One of the most important things to have would be good software tools to do it, a good assembler and debugger. We couldn't do development on the machine we were designing it for. Like on the Apple, we couldn't have the Apple do assemblies and load it into itself and run it because it takes up all of memory, almost every last byte." They spent a half year setting up that development system on an IBM PC with hard disk drives. Once they got the basic simulation going, they started packing in as many features as possible. "We used to have meetings and say, 'We have 30 systems we have to add and only 1300 bytes left,' " says Artwick. "We packed it tighter and tighter until we had just about everything we wanted."

And those features that had to be left out are basically cosmetic, "like the windshield cracking on the IBM version," says Artwick. "It took up a lot of memory, but we had it."

The sequel was just as popular as the original. *Flight Simulator I* was finally knocked off the bestseller charts by *Flight Simulator II*.

The control panel of *Flight Simulator II* resembles the instruments of a Piper PA-28-181 Archer II, a single-engine, nonretractable gear aircraft. It was chosen because it offers good performance, yet is uncomplicated and easy to fly.

You control the aircraft by pressing designated keyboard letters. The right bracket (]) increases your throttle. F makes it bank, and G controls the banking. Press B for a view out the back of the plane, and T for a front view. You'll need to spend a couple of hours learning all the various commands, maybe more if you know nothing about flying. (The program comes with a user's manual and a booklet explaining the concepts of flight physics and aircraft control.)

The first time you take off, you leave Meigs Field in Chicago. From there, you can fly to a number of airports in downstate Illinois, or set the controls to take you to one of the other three designated "scenery" areas: Seattle, New York, or Los Angeles. Flight is in realtime, so if you take off from Chicago before you go to work or school and leave the program running, you can come home for lunch in time to land on the West Coast.

The flying environment is more than ten thousand by ten thousand miles square. It encompasses the entire continental United States and includes more than 80 airports, winds, clouds, time of day (for day, dusk, and night flight), and navigation aids. You can select the flight conditions—even choose between *easy mode*, which makes the aircraft more forgiving of

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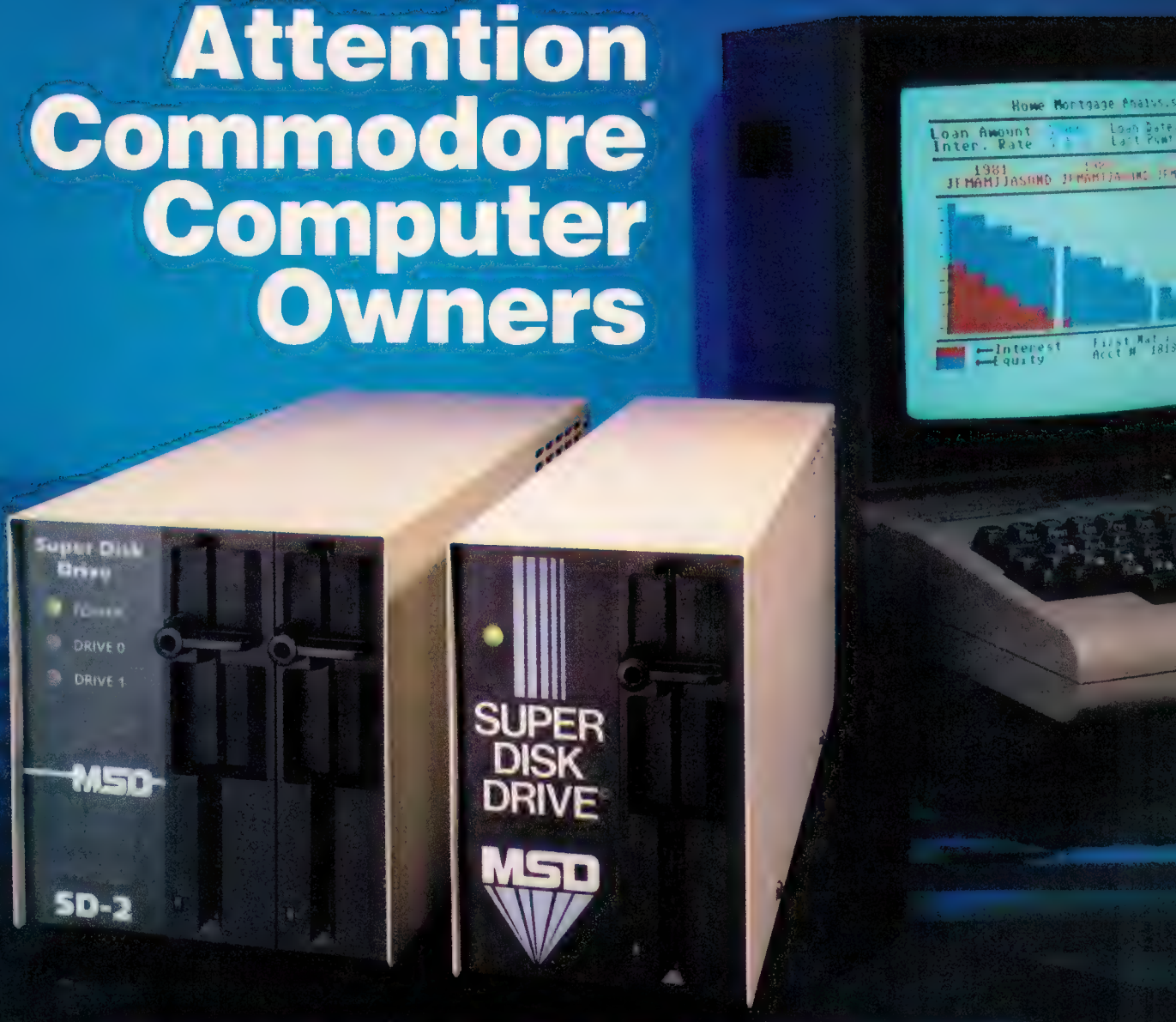

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pilot blunders, and *reality mode*, which adds more sophisticated factors.

If you tire of the challenge of keeping a plane in the air, you can play WWI Ace, the game option which equips the plane with bombs, machine guns, and a radar screen, and pits you against other WWI fighting planes.

More memory, for the engineers at subLOGIC, means faster simulations and more complex scenery (they're already preparing new scenery disks for San Francisco, Washington, D.C., and the Denver/Rocky Mountain area). "We're trying to stay updated on new machines, because we think this is an area of interest that will stay around for a long time," says Artwick.

The Apple IIc has already spawned an enhanced edition called *Flight Simulator IIM*, to be released sometime in 1985. It's a multi-player game. By linking two or more Apple IIc's (either in the same room or via modem), you can fly around in the same air space and see each other, "...go on flights together and hide behind mountains," says Artwick.

In the meantime, *Flight Simulator II* still appeals to a wide age group, "from kids writing in to tell us how well they did on the game to middle-aged pilots who tell us we ought to have more ILS approaches," says Artwick.

And it's being used in training, he says, but not like you might think. "When it comes to training a guy to fly a jet fighter or something, it's not really very good because there are no real flight controls." But flight instructors and national institutions are using it to show students how the gauges and other navigational instruments look and how they work. "In that respect, it's pretty useful, a lot more useful than a textbook."

Artwick has received requests from such far-off customers as the Singapore Air Force, and from people working on research projects for their organizations who want him to make modifications to the program.

And there's one more interesting application for *Flight Simulator II*: Along with *Lotus 1-2-3* and *dBase II*, it's known as a compatibility test for IBM PC compatibles. When Compaq Corporation was testing its machine, the designers found that *Flight Simulator II* wouldn't run. "They had a whole roomful of testers testing it, and it turned out to be a bug in one of Intel's chips," says Artwick. "In their hardware design, it was more sensitive than IBM. Compaq actually had to change their ROMs."

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A Window To The World: Modems In The Home

Sharon Darling,
Research Assistant

With the advent of telecommunications services and on-line data bases, computers can give you a "window to the world" from your home, offering hundreds of productivity and entertainment services.

If you own a Commodore 64 and a modem, perhaps you've considered subscribing to an on-line telecommunications service. Is it worth the investment? Let's imagine the following scenario:

It's seven o'clock on a Thursday night. The library closed at five, and Sammy Jordan has a school report due tomorrow on a subject he hasn't yet researched. Dad has been dabbling in the stock market, studying which stocks he'd like to buy. Now he's ready to plunge ahead, but can't place an order with a stockbroker until 9 a.m. Friday. And he's leaving on a business trip at 8 a.m. Mom meant to stop at the bank on her way home from the office, but left work too late to get there before the bank closed.

To top it all off, Sally's birthday is coming up, and her birthday present wish list contains an item not available in their hometown. The closest store that carries it is 50 miles away.

Such a situation could cause a lot of stress and worry.

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Harcourt Brace Jovanovich COMPUTER SAT	FEATURES	Computer preparation for the SAT THE PERFECT SCORE
Two double-sided	Number of disks	Six double-sided
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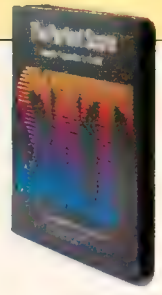
Yes!	Sample test	Yes!
No	Practice SAT and TSWE on disk	Yes!
Yes!	Manual with test taking strategies	Yes!
No	Continuous on-screen clock	Yes!
No	Print-out capability	Yes!



Studying with a computer program makes more sense than using a manual. But Harcourt's Computer SAT ($79.95) gives you a fat manual and just 2 double-sided disks.

For $89.95, Barron's Computer Study Program gives you an even fatter manual, plus 3 double-sided disks.

Why not buy a computer program that's a computer program?

Ours has 6 double-sided disks and a skinny manual. And costs just $69.95.

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No	Based on Successful typing procedure	Yes!
No	Timed paragraph typing test	Yes!
No	Drill on weakest characters	Yes!
No	Progress recorded	Yes!

Unlike Keyboard Cadet, Master Type doesn't show you the correct finger positions on the screen. So you might become a fast hunt-and-peck typist instead of a fast typist.

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But not for our fictional family. They recently subscribed to an on-line telecommunications service for use with their Commodore 64. Now, they're going to put their investment to good use.

Sammy logs on first and gets the information he needs for his report from an on-line encyclopedia, then looks through a special interest group (SIG) data base to get a few more facts. He downloads the data, prints it out, and starts writing his report. Next, Dad accesses the financial services section and places his stock order. He can now leave for his business trip without worrying. He knows the stockbroker will receive instructions as soon as the office opens and will immediately place his order. Dad will later receive confirmation of the purchase.

While he's on-line, Dad also checks the weather forecast for the city he's going to on his business trip. Since the report is calling for rain, he packs a raincoat and umbrella.

It's Mom's turn next. She visits the bank, which is a member of the telecommunications service, and transfers money from savings to checking. She also looks through merchandise available in the service's on-line shopping mall and orders a birthday present for Sally.

While this is only a fictional scenario, the services described are used every day by thousands of computer owners who log on right from their homes. Today, there are a growing number of companies offering well over a thousand different on-line services and data bases which can make many routine household tasks more convenient—even fun.

On-line services have come a long way in a relatively short period of time. Take, for example, CompuServe, the largest of all such home-based telecommunications systems, with 145,000 subscribers. Started as a time-sharing service for businesses, home computerists were first allowed access to the system in 1979.

At the time, it was a data base for hobbyists says Paul Battaglia, a CompuServe spokesperson. A CB radio owners' interest group was one of the most popular services. There were under one thousand subscribers, and only about 25 different data bases which could be accessed. By 1980, the number of subscribers had increased to about 5,000. Today, there are more than 800 different data bases, special interest groups, and services, covering almost every topic, from aviation to world news.

The Source, another popular system, has roughly 60,000 subscribers right now, and offers hundreds of data bases in six major categories—business and finance, travel, games, consumer services, news and sports, and communications. Dow Jones has well over 120,000 subscribers. While most of its offerings are geared toward business users, there are several services which appeal to the home computerist, such as movie reviews, sports and weather reports.

If you've been looking for additional uses for your computer, joining an on-line service could be one of the most rewarding. Let's take a look at some of the options available.

Buying stocks, bonds, and other securities on-line is a relatively new concept for the services. It is currently available to subscribers of The Source and CompuServe, for example, through different brokerage firms.

You open an account with either Max Ule & Company, if you are a CompuServe subscriber, or Spear Securities, Inc., if you have joined The Source. The brokerage houses are members of these two major services. With CompuServe, you must also have access to its Executive Information Service. Security, accessibility, and guaranteed service are very important in any of these computerized systems. For example, subscribers must clear a number of security levels before placing their buy and sell orders. This makes the chances of illegal entry "minute," according to Richard A. Baker, CompuServe's director of corporate communications.

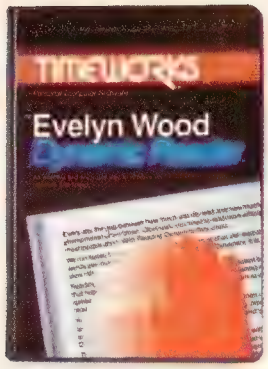
Besides buying stocks, other financial information is available on The Source and CompuServe, as well as Dow Jones News/Retrieval, one of the most respected business-oriented telecommunications networks.

Computerized banking, while still in its infancy, is a fast-growing service. CompuServe, Chemical Bank's Pronto Home Information and Banking System, and a few others let you do your banking from the comfort of your living room. Right now, CompuServe has agreements with three banks (Shawmut in Boston, United American Bank, Memphis, and Huntington National Bank, Columbus, Ohio). Baker says more banks will probably be added to the network later.

Chemical Bank's Pronto system, which can be used by Commodore 64 owners, topped 10,000 subscribers last summer. It offers users the ability to pay bills, transfer funds, get balances, see electronic statements, track budgets, and balance checkbooks.

In addition, the bank has licensing agreements with eight other banks coast-to-coast. Another on-line system, Keyfax Interactive Information Service, based in Chicago, offers home banking, educational packages, data bases, and financial options. A home shopping service is planned as well.

While The Source does not



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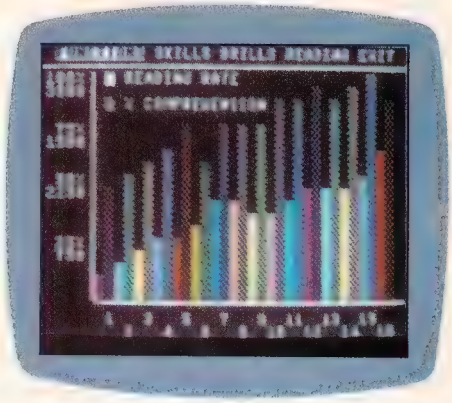

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have home banking yet, it probably will be added in the future, says JoAnne Montgomery, a Source spokesperson.

There are many types of at-home shopping services available. Perhaps the best known is Comp-U-Card's Comp-U-Store, which is available on CompuServe, The Source, and Dow Jones.

Subscribers to these services pay an additional fee to belong to Comp-U-Store, which offers more than 60,000 items from national manufacturers and stores. Comp-U-Store also offers discounts of up to 40 percent on its merchandise.

Right now, Comp-U-Store has 16,000 on-line subscribers and 800,000 telephone subscribers who do not have access to a computer, says Lynn Booth, director of corporate communications for Comp-U-Card International. She says the popularity of the service is growing because "more and more people have home computers, and they find they don't have the time to spend browsing or comparison shopping, so they use a service like ours."

CompuServe introduced the Electronic Shopping Mall last April, which offers goods from about 90 national merchandisers like Sears, Bloomingdale's, and Waldenbooks. Battaglia says that while the electronic mall is popular, "I don't think it's ever going to replace going out to the store and buying goods—there's a certain social function involved (in shopping), and I think this (the mall) is a convenience factor."

Use of such services should grow though, he adds, as people get accustomed to shopping by computer. "Right now, it's a unique thing," Battaglia says, "and I think there are more products that are sold more readily over this kind of medium than other kinds of products.

"A designer dress, for example, would be difficult to sell to the public right now because they're not acclimated to making purchases with just that information at hand."

Shopping by computer should really take off, Battaglia says, when home computers are able to receive sophisticated enough graphics that can show what a product will look like, versus a word description of the merchandise.

Whether it's financial information you need, or material for a school paper, or even the answer to a trivia question, you can probably get the facts you need from one of the on-line services. Sports news, encyclopedias, weather reports, news items from national and international wire services, movie reviews, and newspapers are all examples of information you can access with your computer.

And there are special interest groups of every type available as well, ranging from people who own specific kinds of computers, to pilots, to home canners.

If you're planning a trip, you can check the Official Airline Guide (OAG) to find the best ticket prices. Even making airline reservations from your home has become a simple procedure with your computer.

Another popular feature which ties directly into your home is electronic mail. According to Montgomery, The Source's electronic mail service "gets the most use from consumers and business." CompuServe's Battaglia also attests to the popularity of the service. Electronic mail is "hot" right now, for both consumers and business users, he says.

Unusual subject areas can be accessed. CompuServe, for instance, offers an advice columnist, Aunt Nettie, as well as information on PGA golfers, insurance, humor, and human sexuality.

On The Source, categories include collectibles, classified advertisements, teens, and schedules of the U.S. House of Representatives. Those services are but a sample of what's available. To list every subject category offered by the various services might take an entire magazine.

Of course, it costs money to join any of the on-line services. A basic subscription will cost you roughly the same price as a piece of commercial software. The Source reduced its subscription fee this fall to $49.95. Getting on-line with CompuServe costs about $40, although many modem manufacturers offer a free subscription to CompuServe as part of the package.

Dow Jones has three different levels of membership, with prices ranging from $50 to $75. In addition, there are charges from each service for the amount of time spent on-line. Some of the services, such as sending an electronic mail letter, also require an extra fee.

In addition to the sign-up fee, most services charge an hourly rate for time spent on the service. It generally costs more during business hours, but in the evening, the rates may be as little as six dollars an hour. And if you have to call long-distance, the time is charged against your phone bill (many services have local numbers you can call, so you can avoid paying long-distance bills). The telecommunication options available by home computer are expanding every day, and there are no signs of slowing down. Modems remain one of the most popular peripherals for Commodore 64 owners, a fact not lost on the major on-line systems. Will this expansion continue? CompuServe is already planning to increase its mainframe computer capacity by 90 percent over the next two years. And everyone else seems to be following suit.

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A Visit With Sweetums The Ogre

Fred D'Ignazio, Associate Editor

I had the thrill of my life last week.

I'm the "children and computers" commentator and product reviewer for The NewTech Times TV show (each week this fall and next spring on PBS), and I got to visit Jim Henson's Muppet Mansion in New York City to review the *Muppet Learning Keys*, a new computer keyboard for children from Henson Associates, Sunburst Communications, and Koala Technologies.

When I stood outside on the street, the Muppet Mansion looked to me like any other posh dwelling on Manhattan's upper East Side. But when I walked through the front door, I left the city behind and entered the world of Jim Henson's imagination.

The mansion's foyer is dominated by a three-story-high muppet balloon—rather, balloons on top of balloons on top of balloons stretching up to the distant ceiling. Tiny muppets cling to the balloons and float around them on all sides.

The muppet puppeteer's room is around the corner, behind the stairs, and there I saw a drawer full of Kermit heads and Gonzo perched lazily atop a bookshelf.

I left the balloons, the puppeteers, and the Kermit heads behind and climbed the stairs. Sweetums the Ogre was waiting for me on the second floor. Sweetums is a tall (very tall) ogre whose film career dates back to a monster "extra" part he played in Kermit the Frog's movie debut, *The Frog Prince*, in 1971.

Sweetums is not the sort of creature I'd like to bump into on a dark night. He's big, hairy, and all mouth. And he doesn't walk, he gallops. When he saw me, he galloped across the floor and gave me a friendly, bone-stretching ogre hug. I felt like I'd been swallowed by a furry rug.

Sweetums volunteered to be my child tester

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and help me review the *Muppet Learning Keys.* I've worked with lots of children, but I've never worked with an ogre before, so there were a few things we had to get straight. First, I had to tell Sweetums not to eat the floppy disk that comes with the keyboard (he got the disk stuck on his snaggle tooth). Second, we had a very undignified tug-o'-war when we first got the keyboard. Sweetums wanted to play with the keyboard first, and when I told him I needed the keyboard, he turned his back to me and pouted. Third, Sweetums does not speak English. He only speaks "ogre." So I had to learn what things like "Grrrr . . . Mmmmm . . . Hrrumph . . . Um-Be-Dum-Be-Dum-Be-Dum-Be-Dum" meant. I paid attention (it's hard not to pay attention to Sweetums), so I eventually caught on.

My favorite part of the review was when Sweetums picked up the Commodore 64 keyboard and tried to press the keys. His big, furry monster fingers squashed six or seven keys at a time. So now I know. If you have an ogre in your family, a Commodore 64 keyboard is not adequate.

But you might look into the new *Muppet Learning Keys.* Sweetums' fingers worked fine on the big, widely spaced keys. And so did my adult fingers, too. When I played with the keyboard I learned how nice it was to have big keys in bright colors. My fingers were tired of cramped computer keyboards. The keys are arranged in alphabetical order, so they are not suited for touch typists. But they are great for the one-fingered typists of the world, kids or adults.

There were two things about the keyboard I liked in particular. First, it was like a non-computer person's version of the Macintosh "desktop" environment. The Macintosh, as you probably know, has a display screen that shows little icons, or pictures, that are supposed to resemble items found on a person's desk at his or her office, including a wastebasket, file folders, an alarm clock, and so on. This "desktop" metaphor is all right for someone in an office, but it's not very exciting for little kids and for people who don't get that turned on by desks. And, besides, it's not really a desk, it's a picture screen. And the pictures are black and white and so tiny you have to squint to see them.

The "Anywhere" Desk

The *Muppet Learning Keys* also pretend to be a desktop. They plug into the Commodore 64 keyboard in joystick port 1. The keyboard is 14 by 15 inches, and about an inch high. You can prop the keyboard in your lap, or better yet, you can dive to the floor, and set up your "desk" there.

On top of your desk is a ruler, marked in inches, with big numbers, from 0 to 9. The numbers are really the number keys on the keyboard—rounded bumps on a flat, membrane keyboard.

Beneath the ruler is a paintbox with lots of watercolors, including yellow, orange, blue, red, and violet. Each color has a label beneath it. To select a color, you just stick your finger in the appropriate paint dish.

A little green chalkboard sits beneath the paintbox. Written in white chalk are the letters of the alphabet, in capital letters, and in alphabetical order. Underneath the chalkboard is one of those marbly assignment books with a Space key (it looks like outer space, with a comet and stars), and round arithmetic keys: plus, minus, multiplication, and division.

On the right side of your desk is a button that looks like you could pick it up and pin it on your shirt. It says "Zap" and you use it to escape from an activity and go back to a menu.

Beneath the Zap key is an eraser, so you can back up and erase mistakes. Next to the eraser is a compass. It's like a real compass that tells you North, South, East, and West, with arrow keys pointing up, down, to the right and left. It's an official Frog Scout Compass. You know that for sure because there's a famous green frog's face in the center of the compass.

In the lower righthand corner of the desk is a comic book. It's opened to the middle (you can see the staples). There are four cartoons showing.

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There is a picture of Super Gonzo being launched by a cannon toward a brick wall shouting, "Oops!" When you press this picture, you can undo a mistake you've made.

There's a picture of Miss Piggy tied up on the railroad track crying, "Help!" If you use computers regularly, it's not hard to figure out what this key is for.

A cartoon of Fozzie Bear with a police cap and STOP sign and a picture of Kermit on a motorcycle underneath a green traffic light that says GO disguise keys that enable you to start and stop activities and animate pictures on the screen.

To make your desk work, you need software. And now we've come to the *Muppet Learning Keys*' chief drawback. For $80, the keys come with a "Muppet Discovery Disk" created by Sunburst Communications. But that's it for now. According to Koala, many more disks are on the way, as well as overlays that fit on top of the keyboard so you can use it for different activities with different aged children. But no more software now is a real limitation, since the *Muppet Learning Keys* are a real keyboard, and it would be great if children and adults could use it as an alternative to the standard keyboard. But to do that, they need software.

The software that comes with the keys is limited, but it's also good. And this brings me to the second reason why I like the keyboard: It has succeeded in turning the computer into an electronic playground. I've claimed in many of my columns in the GAZETTE that my children (ages 8 and 5) spend most of their time on our Commodore 64 just banging on the keyboard and not using any software whatsoever. They know the computer far better than I do, just by experimenting with the different keys and looking at the display screen to see what pops up. This is "discovery learning" at its best, and it's also what you get with the *Muppet Learning Keys.*

To find out more about the *Muppet Learning Keys,* contact:

Koala Technologies
3100 Patrick Henry Drive
Santa Clara, CA 95052-8100
(408) 986-8866

When you call Koala, tell them Sweetums and Fred sent you. And tell them to get busy making new software!

The Computer Book Shelf

When I'm not in faraway places playing with ogres, I'm back in my house in Roanoke, Virginia, writing—and reading. Here are some of the books I've looked at recently that I recommend to families.

Scholastic Books has a new series of four computer activity books which are popular with me and my eight-year-old daughter. Each book costs only $4.95 and contains dozens of programs that kids will like to enter into their Commodore 64.

The books are all written by Paul Somerson and Stephen Manes and are titled *Computer Space Adventures, Computer Craziness, Computer Olympics,* and, my favorite, *Computer Monsters.*

The books don't start with a boring table of contents. Instead they begin with messages like "Greetings, Earthling!" or "Welcome, Human!" Then they tell kids the basics they'll need to know to enter a program on the computer. And they start showing kids programs, sample output, and weave it all into scenarios starring silly creatures, secret space missions, nutty numbers, and magic codes—a delightful smorgasbord for your 8- to 12-year-old.

When you get tired of monsters and rocket ships, you can come back to earth and try *1, 2, 3, My Computer & Me!* by Jim Muller (Reston, 1984, 96 pages, paper, $12.95). Muller is the Honorary Turtle and co-founder of the Young Peoples' Logo Association (P.O. Box 855067, Richardson, TX 75085—or call the Midnight Turtle bulletin board on your computer by dialing 214-783-7548).

1, 2, 3, My Computer & Me! is a workbook that children (ages 5 and up) can do with their parents. The book is an introduction to Logo thinking, programming, and playing. There are lots of exercises and experiments to do, and lots of blank space in the book for children to draw their own pictures, take notes, color, and just doodle. If you and your children are just beginning to use computers, I recommend this book as a very gentle introduction.

If your children are even younger and your wallet is flatter, you might want to look at *COMPUTERS!* (Golden Book, 1984, 32 pages, paper). This book, at only $1.95, has to be the least expensive computer book on the market, and one of the best buys.

As with Muller's book, the emphasis in this book is on parents and children working at home together. The book is suitable for children ages five and up, and has two pages of stickers, games, experiments, and lots of other activities that parents and children can do with or without a computer. So get your pencils, glue, scissors, and crayons, Mom and Dad, and begin computing!

After you've been down in the trenches with your kids for heavy-duty glue-and-sticker computing, you may want a change of pace—food for thought instead of something gooey to stick to your fingers. In this case, you might look at *Buy A School For Your Home* by Judy Lower with Ed Neil and Tim Finger (Reston, 1984, 265

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pages, paper, appendices, bibliography, $14.95) or *Bank Street's Family Computer Book* by Barbara Brenner with Mari Endreweit (Ballantine, 1984, 251 pages, appendices, bibliography, indexes, paper, $8.95).

Both books are intended for families who are just beginning. They answer your basic questions—for example, "Why should we buy a home computer?" And they give you plenty of information about how to buy a computer, how to shop for software, and most important, how to use the computer and software once you've got them home.

Buy A School has separate chapters on using computers with different aged children, and carries with it a strong emphasis on families using computers together and using computers as a learning tool. It also contains a 110-page section reviewing some of the better family programs.

Family Computer Book is rich with case histories about real families who have begun computing, based on the extensive experiences of the researchers at Bank Street College's Center for Children and Technology. It guides parents through the ins and outs of computer jargon and offers specific tips on how to select the right computer equipment and software for the family.

Both books are especially helpful, however, because they don't just keep to the specifics—the logistics—of family computing. They also have the insight and sensitivity to explore the bigger issues parents face when they invest in a computer for their family.

For those families who are past glue-and-crayons computing, and have already mastered the fundamentals, I recommend Eugene Galanter's *Kids & Computers: Advanced Programming Handbook* (Putnam/Perigee Books, 1984, 224 pages, appendices, index, paper, $8.95). This is the third in the series of Kids & Computers books by Galanter and is intended for the older child, age 12 and up, who is already programming. I liked the book because it reminded me of a junior version of my computer science courses back at the University of North Carolina. This book is a home-study course in computer science for a student to take to supplement a course he or she is taking in school, or to read alone to pick up some new programming tricks and techniques like structured programming, using files and data structures, and creating basic sorting and searching algorithms. The book is thorough, but I offer one warning: It reads like a textbook. It's for the child who is already motivated, and not for the hesitant beginner.

Catalog Time!

Each month I get a bushel basket full of new computer catalogs brimming with new software suitable for the family. I recommend that you take a look at several of these catalogs because they give you the chance to comparison shop for different kinds of software right in your own home.

Here are the best catalogs I've received:

Special Learning Ed Software (SLED)
(specializing in spelling programs)
P.O. Box 16322
Minneapolis, MN 55416
(612) 926-5820

Selected Microcomputer Software/Elementary
Opportunities for Learning, Inc.
8950 Lurline Avenue
Dept. 2P
Chatsworth, CA 91311
(818) 341-2535

Quality Educational Microcomputer Software
Charles Clark Co., Inc.
168 Express Drive
South Brentwood, NY 11717
(516) 231-1220

The Children's Software Catalog
Evanston Educators, Inc.
1718 Sherman Avenue
Evanston, IL 60201
(312) 475-2556

Sunburst Educational Computer Courseware
(preschool to adult)
Sunburst Communications
Room BC39
Washington Avenue
Pleasantville, NY 10570
(800) 431-1934

Microcomputer Educational Programs MCE, Inc.
157 South Kalamazoo Mall
Kalamazoo, MI 49007
(800) 421-4157
(in Michigan, 616-345-8681, collect)

Scholastic Microcomputer Instructional Materials
(grades K–12)
Scholastic, Inc.
P.O. Box 7503
2931 E. McCarty Street
Jefferson City, MO 65102
(800) 325-6149
(in Missouri, 800-392-2179)

1984 Instructional Materials Catalog
DLM Teaching Resources
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(in Texas, 800-442-4711)

Time Saver II
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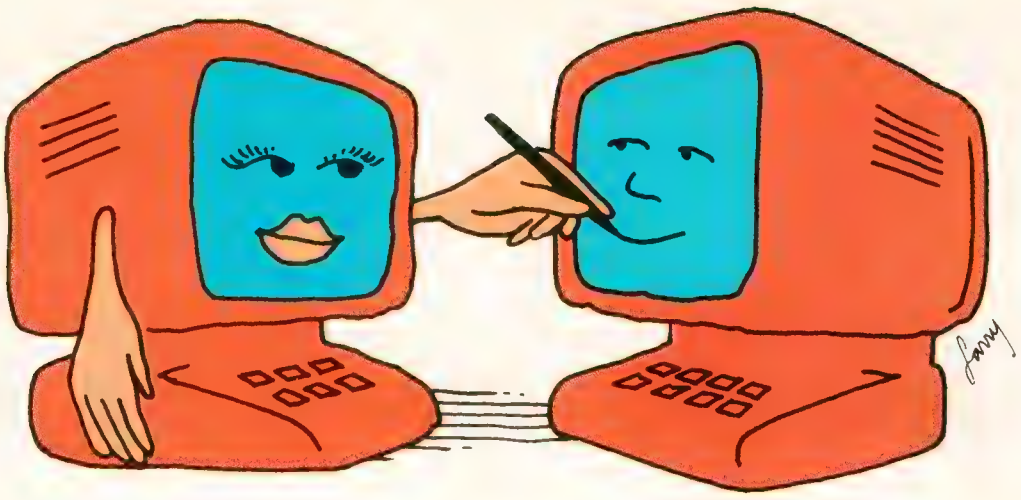


VIC Magic Draw

Kevin Gough

Turn your computer into a high-resolution sketchpad with this program. The pictures you create can be saved to tape or disk. Requires at least 8K of expansion memory.

Here's a program that lets you create high-resolution pictures on a 176 × 160 dot grid. "VIC Magic Draw" requires 8K or more expansion memory. After the program is typed in and saved to disk or tape, you must change the start of BASIC and the screen, before loading the program.

There are two ways to do this: manually or with a boot program. Manually, type POKE 648,30:SYS 58648 and press RETURN. Now type POKE 642,32:SYS58232 and press RETURN. Your VIC will display the usual "CBM BASIC V2" at the top of the screen, except the number of bytes free is 3584 less than when you turned your VIC on. That's because the start of BASIC and variables have been moved (to 8192).

The other method for moving memory is a boot program that automatically loads Magic Draw. Program 1, "Magic Draw Boot," does this for you. It consists of five lines of BASIC If you're using a disk drive, enter and save it as is. If you're storing Magic Draw on tape, change the device number at the end of line 30 from 8 to 1. Make sure you store this boot on your tape before the Magic Draw program. If you're storing Magic Draw on disk, then change the device number at the end of line 30 from 1 to 8.

Three simple machine language programs are automatically POKEd into certain areas after running Magic Draw. They have the functions of saving and loading hi-res pictures that you create, from disk or tape, and clearing the screen of any extraneous matter. These routines are DATA statements in the BASIC program, so take care typing them in. A checksum is performed to make sure the data was typed in correctly, so if there is any wrong data you will be notified.

Here's a list and explanation of Magic Draw control keys.

SHIFT/CLR: This clears the high-resolution screen of any plotted dots. After the first run of Magic Draw, you'll want to clear the screen of any random garbage. After clearing it, you'll see the flashing pixel at the center of the screen.

SHIFT/CRSR (up): This moves the pixel cursor up one dot.

CRSR (down): Moves the pixel cursor down one dot.

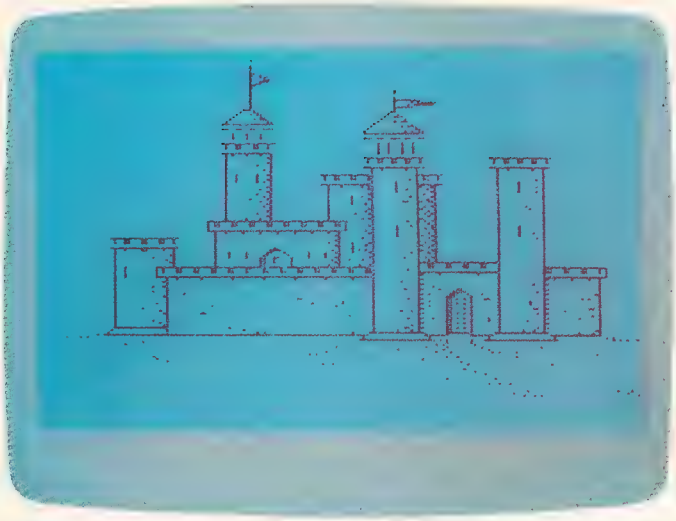
SHIFT/CRSR (left): Moves the pixel cursor left one dot.

CRSR (right): Moves the pixel cursor right one dot.

HOME: Moves the pixel cursor to the center of the screen.

X: Plots one dot in the current position of the pixel cursor.

Z: Erases one dot (if present) under the pixel cursor



This hi-res castle was created with "VIC Magic Draw."

D: Draws continuously wherever you move the pixel cursor. Press *D* again to turn this function off.

E: Erases continuously wherever you move the pixel cursor. Press *E* again to turn this function off.

@: The "at" key creates a box-shaped figure to the right and below the pixel cursor. The size of the box is controlled by the plus (+) and minus (−) keys.

+: Increases the size of the box figure by one dot each time the key is pressed. The limit is 90 dots.

−: Decreases the size of the box figure by one dot each time the key is pressed. The limit here is a box two dots square.

G: Graphs a pattern of dots on the screen 8 × 8 dots square. This is useful for drawing precise, dimensioned pictures. Press SHIFT and *G* to erase the graph.

Q: Quit the high-resolution draw mode. The screen will clear and return the normal VIC cursor. You can run the program again and still retain your previously drawn picture.

S: Save a picture to disk or tape. Each picture takes up to 3524 bytes. Pressing *S* clears the high-resolution screen and asks for the name of your picture. You next enter 1 for disk or 2 for tape save. After it is saved, you return to the high-resolution screen and your picture. Tape users should make sure that buttons on the Datassette are pressed down. You will be prompted with TAPE OFF? before being prompted to PRESS RECORD AND PLAY ON TAPE. Just press RETURN at the *tape off* prompt and then the record and play buttons on the Datassette.

L: Load a picture. You'll be prompted to type in a name and then a 1 for disk or 2 for tape. If using disk and the picture is not found, an error message is generated. After the picture is loaded, draw mode is entered and your creation is displayed on the screen. The pixel cursor flashes in the middle of the screen.

Adding More Functions

You'll find you have a good amount of memory free after Magic Draw is up and running. Press *Q* and type ? FRE(0). The amount of bytes free is determined by the size of your memory expansion. The extra memory allows you to add new functions. A screen dump to the printer (1515 or 1525) has been added. I've used the program on page 112 of *COMPUTE!'s First Book of VIC*. Now, suppose your screen and the bottom half was blank. You wouldn't want to wait double the time it takes to print out the entire screen. So we must add a line between line numbers 6 and 7. This BASIC line will also serve to end the print routine when the printer is done with the screen:

```
GETA$:IFA$="F4"ORL>154THENPRINT#4,CHR$
(15):CLOSE4:RETURN
```

If you press f4 while the printer is dumping the screen, the PRINT routine will end and you'll be returned to the draw mode. Printing the entire screen takes about 35 minutes.

See program listings on page 156.

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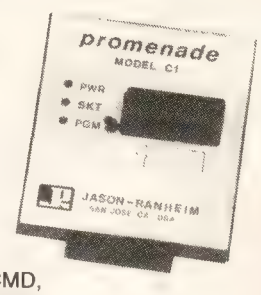

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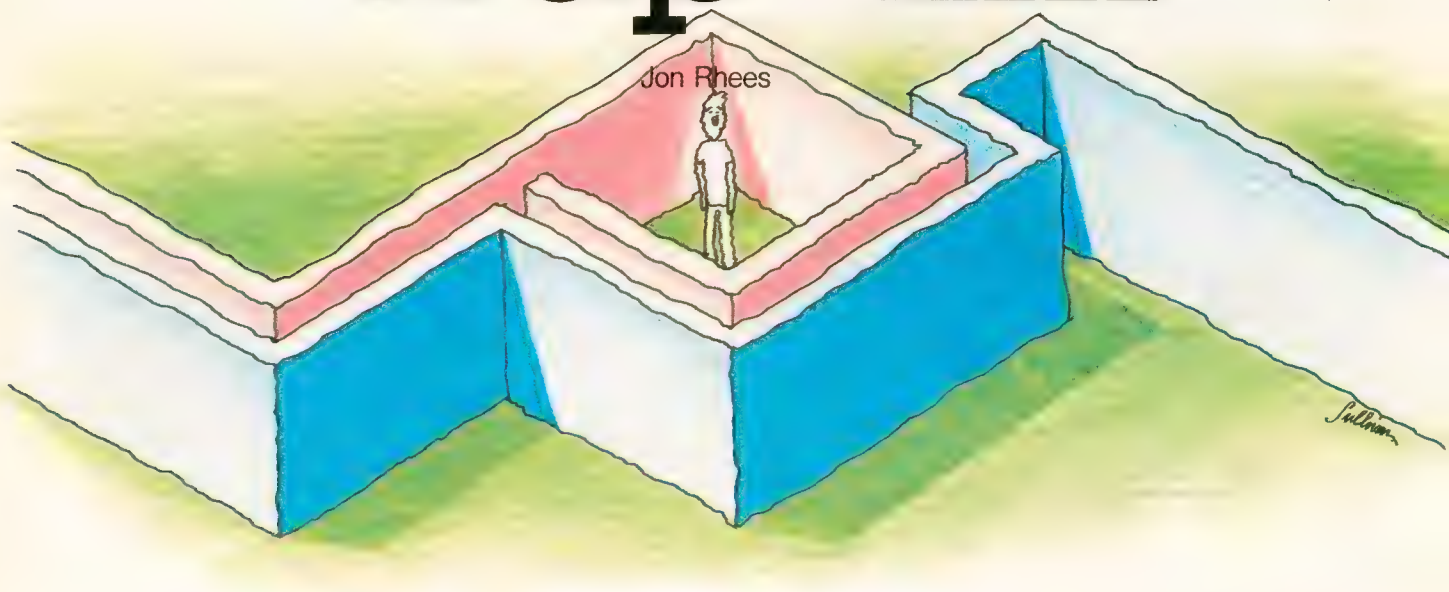


Build fences around your opponent without letting yourself get hemmed in. This simple game includes a variety of options to keep it ever-challenging. Originally written for the 64, we've added a VIC version.

This game puts you in the construction business. Specifically, you're building fences, and the construction code is straightforward: Fences may be built horizontally or vertically; your construction may not touch the outer walls, your previous work, or your opponent's work; nor can it touch any obstacles that may be strewn in your path.

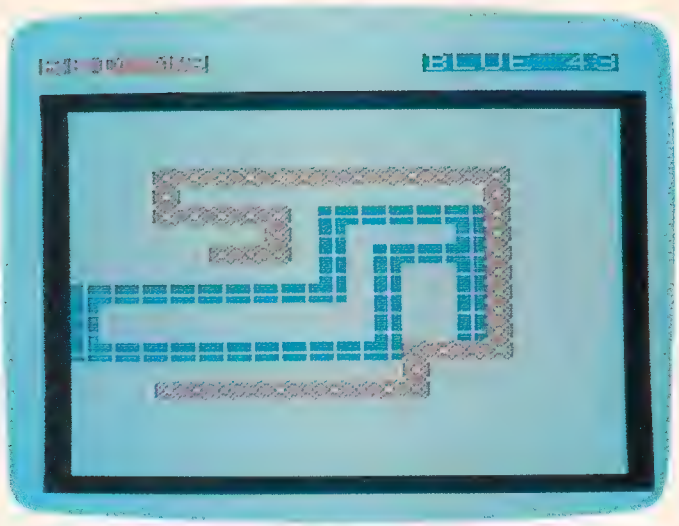
You score points by outlasting your rival. If his fence crashes first, you win the round and a number of points based on the amount of time consumed by the round. The first player to reach 100 points wins the game.

The choices available in setting up the game are: one or two players; joystick or keyboard input; adding obstacles to the playfield; and increasing or decreasing the speed of the game.

Approximately 30 percent of the program—the game action itself—is written in machine language. The sound, timing, and scoring routines are written in BASIC. Accompanying the article is a line-by-line description of how the 64 version works. The VIC version is similar, so the program description also applies with a few exceptions.

Commodore 64 Program Description

Lines	Description
100–120	Call the option routines and initialize variables.
130	Checks for winner and jumps to win routine.
140–150	Draw screen border.
160	Checks for barrier option, jumps to subroutine.
190	Positions players and directions. (Locations 251–254 hold low and high bytes of each player's position. Locations 837–838 hold player's directions.
200	Initializes time and calls machine language routine, which returns to BASIC when collision occurs. Score is then determined based on amount of elapsed time.
210–230	Check value in location 834 for number of player in collision, then jump to appropriate routine to update winner's score.
245–250	Flash colliding fence.
270–480	Allow player to choose options.
490–510	Randomly place barriers on screen.
520–550	Initialize sound and variables.
560–660	Print scores and totals, then jump to beginning.
670–1350	Load machine language portion of Commodore 64 version.



In the two-player game, Red has trapped the Blue player (VIC version).

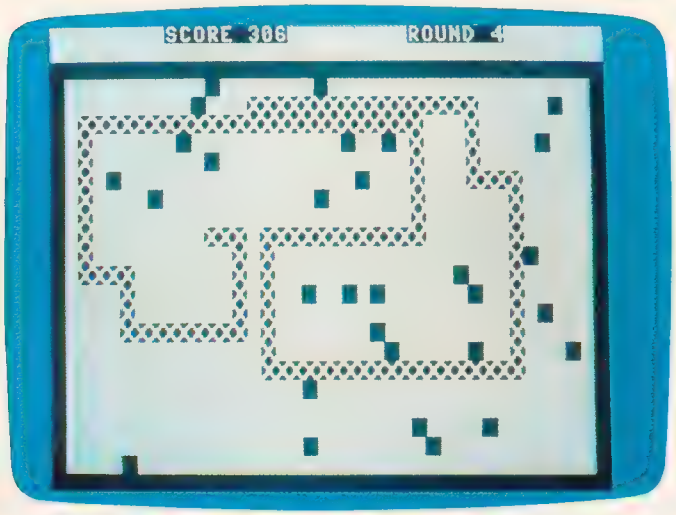
The game is best when played by two people. The one-player option was added so players could practice if no opponent could be found. You race the clock, trying to survive as long as possible. If you use the practice option, the most challenging level is nine, with obstacles. You have ten rounds to rack up as many points as you can.

Note To VIC Users

Programs 2 and 3 comprise the VIC version of "Trap 'Em." First, type in Program 2, the game loader, and save it to tape or disk. If you're using tape, change the 8 to a 1 in line 130.

Next, type in Program 3, the main game, and save it with the filename "VT". If you're using tape, be sure to save Program 3 *immediately* after Program 2. This will automatically load Program 3. In the VIC version, the ML routine is POKEd in lines 100–880 of the loader program.

See program listings on page 157.



Practicing in the one-player game, with barriers (64 version).

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Chomper

George Hu

In dire need of energy crystals, your spaceship has landed on an alien planet. But the crystals are guarded by soldiers and a vicious droid. Act fast because time is running out. For the VIC and 64; joystick required.

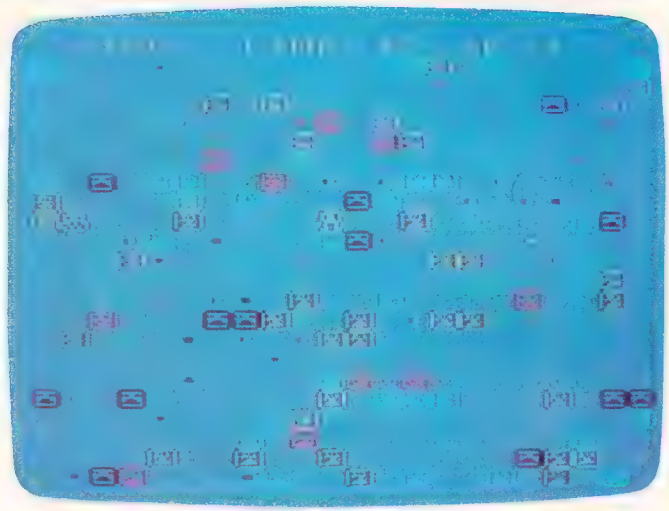
You are a space explorer from the planet Earth. During your voyage, your ship encountered a meteorite belt and most of your ship's energy was drained in protecting the ship. You encounter a strange planet which contains crystals that can restore your ship's power. Unfortunately, the planet is guarded by dormant soldiers and vicious droids. You send a probe, nicknamed Chomper, to collect the crystals.

Using your joystick maneuver Chomper across the planet's surface and gobble up as many energy crystals as fast as you can. For every crystal you collect, you receive 150 points. If you hit a soldier, you lose 450 points. If you allow a droid to catch Chomper, he is destroyed—and that spells doom for you and your mission.

Racing The Clock

You have 45 seconds in which to collect as many crystals as you can. If you earn 3000 points, you will be given bonus time. The first bonus is 45 seconds. Each bonus you earn decreases the next bonus time by 5 seconds. If you earn 6 bonuses, you get a new Chomper in a different section of the planet, with 45 more seconds of play. If you would like more crystals, press the fire button. But beware: More crystals mean more soldiers.

The game begins with a diagram of joystick positions. Push the joystick right for easy play; push it left for harder play. Pushing the stick up increases the number of droids: up to seven for the 64 version or two for the VIC version. After your selection, the playing field and the droid(s) are randomly placed on the screen. The score, time remaining, and bonuses are displayed at the top.



Press the fire button to instantly create more crystals—and soldiers (VIC version).

After the game is over, you may be asked to enter your name for a high score. Type in your name and press RETURN. Another diagram will appear with the session's high score on top. Push the joystick up for the same level, right for a different level, and down to end the game.

Variable	Contents
L	Score needed for bonus
S	Present score
G	Total bonus time received
V	Bonuses reached
R	Amount of next bonus
W	Droid being controlled (1 or 2)
X1	Chomper's X coordinate
Y1	Chomper's Y coordinate
C	Chomper's screen location
X(N)	Droid's X coordinate
Y(N)	Droid's Y coordinate
D(N)	Droid's screen location
C1	1 or 2 droids
F	Ratio of Chomper moves to droid moves
BS	High Score
N$	Name of high scorer
M	Multi-use counter

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Your chomper has limited time to mine energy crystals and avoid the droids (64 version).

Customizing The Skill Level

If you find the game is too hard, or too easy, the skill level can be adjusted in several ways. The easiest way is to change the bonus time. By changing the value of R in line 390, the bonus time can be changed. By changing the 6 in the last statement in line 210, you can change the number of bonuses required to get a bonus screen. By changing the value of F in lines 460–480, you can adjust the ratio of Chomper's moves to the droid's moves.

64 Version Notes

Other than allowing up to seven droids, the 64 version plays the same as the VIC version. If you have a black-and-white screen, press the fire button at the beginning of the game until a B appears. This adjusts colors so you can play on a non-color TV or monitor.

The 64 version is entirely in machine language, and MLX (elsewhere in this issue) is required to enter the program. After loading and running MLX, answer the starting address prompt with 49152, and the ending address with 50891.

To run the game, type SYS49152. Also, be sure to load the game with LOAD"*filename*",8,1.

If you'd rather not type in the program (VIC version only), send a blank tape, $3, and a self-addressed stamped envelope to:

George Hu
16212 122 Ave. SE
Renton, WA 98055

See program listings on page 165.

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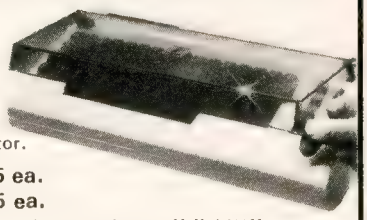

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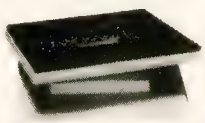

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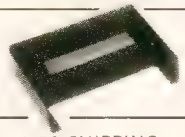

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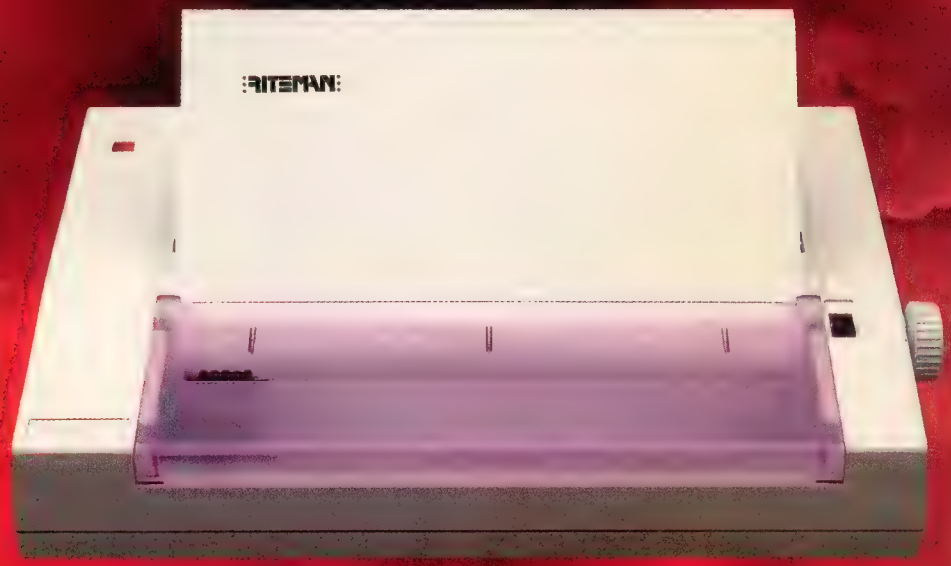

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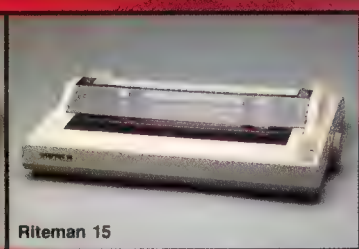

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Kablam!

Stephen Ressler

A prankster perched on the top of your apartment building is tossing firecrackers on to the street. Your job is to maneuver a water-filled bucket to catch and extinguish the firecrackers. An arcade-style action game with versions for the VIC and 64. A joystick is required.

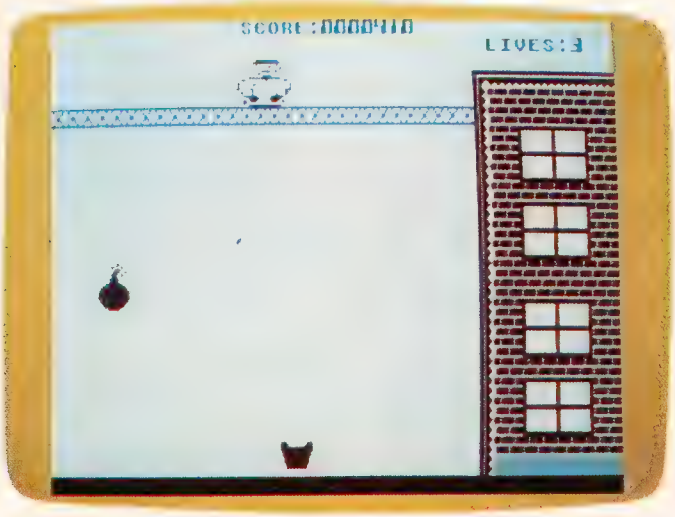
Your once-quiet neighborhood is suddenly being showered with firecrackers. And the culprit won't let up. You arive on the scene in a mad dash to extinguish the firecrackers in a bucket of water.

Take It To The Limit

When the title screen appears, you'll be asked to choose one of 15 skill levels, 1 being the slowest and 15 the fastest. You'll probably want to start with an easier level at first to see how the game plays. Then go up a couple of skill levels until you have a competitive game.

Using a joystick (port 2 in the 64 version), move your bucket left and right to catch the falling firecrackers. Note that your bucket can "wrap around" the screen, that is, moving to a far edge will bring you around to the opposite side of the screen. This is extremely helpful at the more advanced levels.

If a firecracker reaches the ground, an



A quick move to the left might catch the firecracker dropped by the prankster (64 version).

The player faces a decision in the VIC version of "Kablam!"

explosion is heard, and one of your four plays is lost. The game ends only when you're out of plays. You can then choose another level and play again.

If things get too frantic or you need a break in the middle of the game, pause the action by pressing the space bar. Press the CTRL key to resume the game.

If you'd rather not type in the game (64 version only), send a self-addressed stamped envelope, a blank tape or disk, and $3 to:

Stephen Ressler
18 Erindale Drive
Marlton, NJ 08053

See program listings on page 168.

Special VIC Notes

The VIC version of "Kablam!" is similar in play to the 64 version, but there are a few differences. You have a total of three plays rather than four, and instead of 15 difficulty levels, there are five. However, the speed of each firecracker increases with each one you catch and decreases with each one you miss—a kind of self-adjusting handicap.

The VIC version also displays the high score, current score, firecracker speed, and firecrackers (plays) left. The SHIFT LOCK key serves as a pause button.

Written entirely in machine language, the VIC version must be entered using a special Kablam! version of "Tiny MLX," found elsewhere in this issue. Once entered and saved, simply load and run in an unexpanded VIC.

If you have 8K or more expansion for your VIC and a copy of the full-featured VIC MLX (published last month and in earlier issues), you don't have to type in Tiny MLX. Insert the expansion memory, turn on your VIC, and enter this line: POKE 642,32:SYS 58232. This POKE and SYS moves the start of BASIC into the memory expander, where it won't interfere with the machine language program. You can then load the regular VIC MLX, and type in Kablam!.

The starting and ending addresses are built into the special version of Tiny MLX. If you're using an 8K or greater expander with regular MLX, use 6291 as the starting address, 7682 as the ending address.

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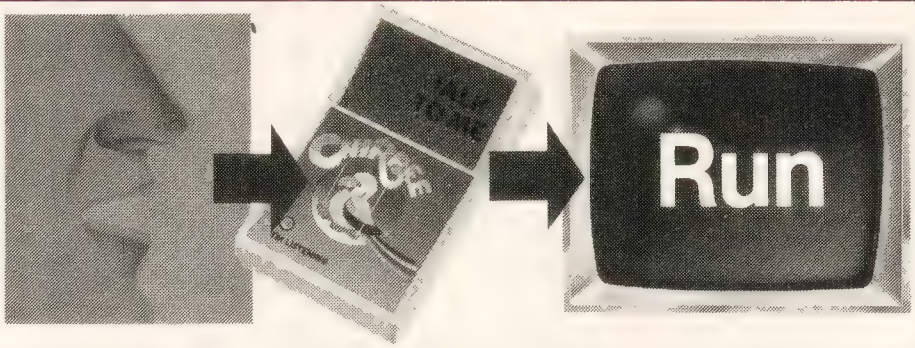

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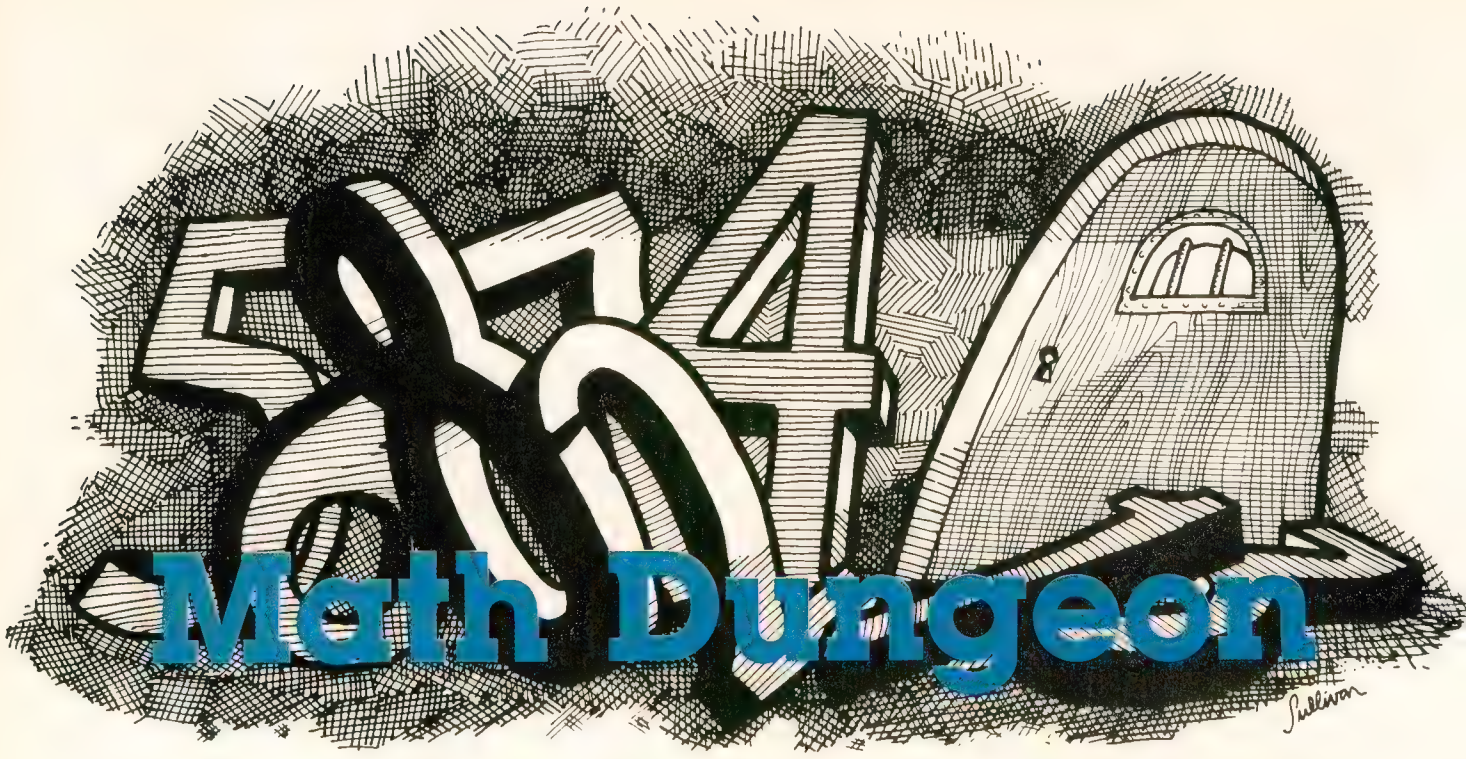

Can you escape the dungeon by finding the key which opens the door? First, you must get by the math monsters who block your way, asking questions about addition, subtraction, multiplication, and division. An entertaining, educational adventure game for the VIC (8K or more expansion) or 64.

At the beginning of "Math Dungeon," you are asked for a difficulty level. Levels one and two deal only with addition and subtraction of positive numbers. Level three adds multiplication and division (still only positive numbers). Four brings in negative numbers, covering multiplication and division. And five asks all four types of questions about positive or negative numbers.

You begin at a gate outside an old mansion. First, find a way through the gate and get to the front door, which is closed. If you can get the door open, you can enter the mansion and you'll be whisked to the underground dungeon. Your adventure begins.

As you wander through the dungeon, you may find different colored keys and doors. The keys are color coded according to the door they open. One of the doors leads out of the dungeon (to end the game).

In your search for the exit, you may also find a map. It can be very helpful. Once you get it, type MAP to see where you are. The map uses R to represent rooms, H for hallways, M for monsters, and * for your location.

The Command Vocabulary

This game recognizes a limited number of words. The verbs are:

GET	Pick up an object
INV	Inventory
LOOK	Look around
OPEN	Open a door
CLOSE	Close a door
ON	Turn on a light
OFF	Turn off a light
MAP	Look at the map
N	Go North
S	Go South
E	Go East
W	Go West

The possible nouns include:

GATE	**LIGHT**
DOOR	**MILKBOX**
NOTE	**GOLD**
KEY	**MAP**

And if you find yourself in a jam, typing ALGEBRA may get you out. Certain commands need only a single word or letter, like LOOK or N. Others combine a noun with a verb, like GET GOLD. The verb usually goes first.

Information about the dungeon is kept in an array FL(10,10), which is filled with rooms, hallways, and monsters in lines 1620–1850. Lines 1620–1640 randomly place monsters, according to the level chosen at the beginning. Lines 1650–1680 randomly place hallways and rooms

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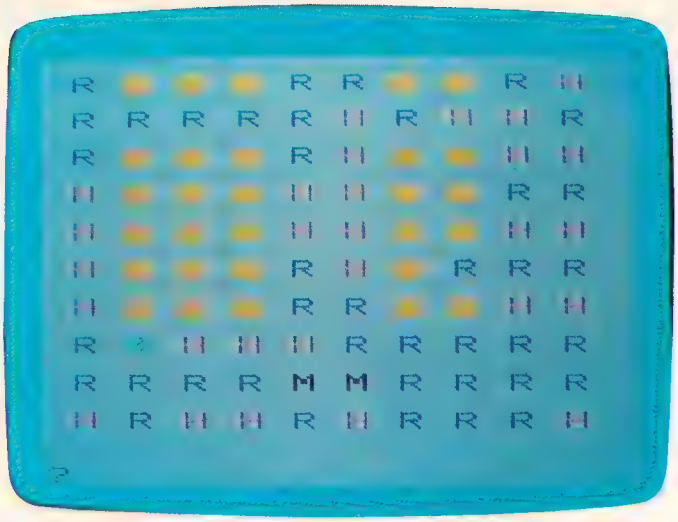
Vanquish the Math Monster by answering a question correctly (64 version).



A map of Math Dungeon is behind one of the doors (VIC version).

throughout the dungeon. Lines 1690–1710 make sure a path is available to each monster. Lines 1720–1770 randomly place colored keys and doors around the array.

The game runs on both the VIC and 64. Playing it on the VIC requires at least 8K of expansion (16K or 24K will work). The SYS at line 120 determines which computer is being used (according to whether there are 22 or 40 columns on the screen) and sets the variable CC. This information is used to format anything which is printed to the screen.

If you would like a copy of Math Dungeon (tape only), send a self-addressed stamped envelope, a blank tape, and $3 to:

Richard Lowe
1905 Kossuth St.
Lafayette, IN 47905

See program listing on page 162.

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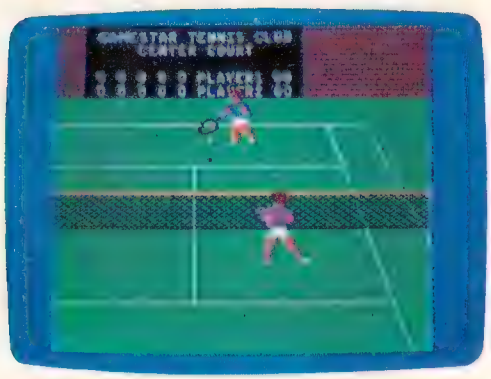

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Magazine Indexer

Daniel Miller

"Where's that article on making backups?" If you're tired of spending time looking through back issues of magazines for an elusive article, let your computer do the searching with "Magazine Indexer." For the VIC or 64, tape or disk.

If you're like a lot of people, you subscribe to several magazines. Every month there are articles you intend to read, or games and utilities you plan to type in. But there's just not enough time. When you eventually get around to them, a new issue has arrived. You fall behind and those interesting articles become lost in the shuffle.

Instant Reference

This program, "Magazine Indexer," runs on the VIC or 64 and provides an instant reference to articles you wish to keep a record of. On the 64, you can store up to 500 records (adjust the DIM in line 100 for more); that is, you can store and review references for up to 500 articles. On the unexpanded VIC, the program can store only 15 articles, although the addition of memory expansion (any size allowed) makes the program far more useful. With an 8K expander, approximately 250 articles can be stored, and with 16K, approximately 500 articles can be stored.

Searching for an article can be done in a variety of ways: magazine title, issue date, article title, or category (article type). The program also provides for deleting references so you can keep the file up to date.

Menu Operation

All of your selections are done via the menu, which first appears when you run the program. Each choice is numbered 1–9. Simply press the number of your selection—you don't need to press RETURN.

1. LOAD ALL ARTICLES
2. LIST ALL ARTICLES
3. ENTER NEW ARTICLES
4. DELETE PREVIOUS ENTRIES
5. LIST ARTICLES BY MAGAZINE
6. LIST ARTICLES BY DATE
7. LIST ARTICLES BY TITLE
8. LIST ARTICLES BY CATEGORY
9. SAVE DATA AND END

When you first use the program, select option 3. To enter data, type in the information when prompted. The field length is highlighted, so you know how many characters are allowed (10 for magazine title; 15 for article title; up to 5 for issue date—for example, 12/84 or 1/85; and 1 character for category). When entering the issue date, be sure to enter the "/" character to separate month and year—don't use commas. For the category, use letters which are easy to associate with the articles, such as U for utilities, G for graphics, E for entertainment and games, and so on.

After you've entered all the information, use option 9 to save your data to Cassette (C) or Disk (D). The program automatically handles the creation and maintenance of the data file (a sequential file with the name "ARTICLES"). If you wish to change this filename, make the appropriate changes in lines 720 and 730. Tape users should insert a blank tape, rewound to the beginning, to store the data. Screen instructions are clear and should eliminate any confusion.

The next time you use the program, select option 1 to load your previous work. Then you can use option 2 to list all articles. There are ten per screen on the 64, and five per screen on the VIC. If you have a larger number of articles, the first batch (five or ten, depending on your computer) is displayed and you are prompted to press RETURN to see the next batch. This technique is used to prevent scrolling of data up the screen.

To delete previous entries (option 4), enter the record number (corresponding to the list displayed with option 1). All entries are automatically numbered sequentially when entered with option 3. Also, the program closes up the numerical sequence of articles after a deletion. For example, if you delete article 7, article 8 assumes the seventh position, and the articles which follow (9 and up) move down correspondingly.

Menu items 5–8 let you search for information by entering the magazine title, date, article title, or category. It works like a small data base.

See program listing on page 159.

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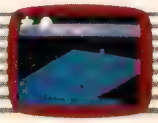

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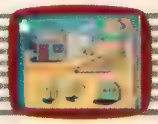

Spell Now

SIMPLE ANSWERS TO COMMON QUESTIONS

Tom R. Halfhill, Staff Editor

Q A

Each month, COMPUTE!'s GAZETTE *tackles some questions commonly asked by new Commodore users and by people shopping for their first home computer. If you have a question you'd like to see answered here, send it to this column, c/o* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

Q. Is it possible to build a RAM disk for the Commodore 64 and, if so, where can I find information on how to do it? Also, wouldn't a RAM disk be a better investment than a disk drive? RAM chips are so inexpensive nowadays (downright cheap, in fact) that you can purchase a 16K dynamic RAM on sale at Radio Shack for a measly $1.99 each. At that rate, you could purchase 2000K of super-fast, repair-free memory for the same $250 that you would have to pay for a Commodore 1541 disk drive. All a person would need to do is borrow a disk drive occasionally to store disk-based programs. A RAM disk with 2000K of memory—which almost equals 12 floppy disks on the 1541—should be plenty for the average user's needs. But if not, I assume that such a RAM disk would have unlimited expansion capabilities. Am I right about all this? Am I on-line or have I made a syntax error?

A. There's nothing wrong with your reasoning, but we're afraid you've made an out of data error.

The chief drawback to using a RAM disk to store programs is that RAM (Random Access Memory) is *volatile*. That is, all the information it holds is erased as soon as the power is shut off. RAM chips must be constantly refreshed with electricity to maintain their active state. Even a split-second power interruption—as often happens during thunderstorms—can wipe out all the data the chips store. RAM is intended for temporary storage only. It's the computer's workspace for running programs. Disks and tapes are meant for more permanent data storage.

Remember that a *RAM disk* isn't really a disk at all, but simply a block of memory which is set up to imitate a disk drive. The block of RAM can be extra memory that you add externally, or part of the computer's existing internal memory. A special program reserves the block of RAM, protecting it from other uses, and treats it like a floppy disk drive.

For example, the RAM disk could be set up as device #9 (a single floppy drive is normally device #8). When you type SAVE *"filename"*,9 the file is saved from workspace RAM to the RAM disk. Since the RAM disk isn't really a mechanical disk drive, of course, the save is practically instantaneous. Loading a file is just as fast. All you're really doing is transferring the file from one part of memory to another.

Therefore, if the power is turned off (deliberately or accidentally), the file is wiped out. The usual practice when using a RAM disk is to copy the file from the RAM disk to a real floppy disk before ending the session and switching off the computer. Why use a RAM disk at all? Because some disk-intensive programs—such as data base managers which frequently access the disk drive—can run much faster with a RAM disk. But the final copy must always be saved onto an actual disk or all the work will be lost.

It would be possible to use a RAM disk for more permanent storage if it were left switched on 24 hours a day, preferably with battery back-

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up in case the unexpected happens. But building such a device yourself would be a formidable task.

For one thing, the 16K RAM chips you've seen on sale at electronics stores such as Radio Shack don't store 16 *kilobytes*. A 16K RAM chip actually stores 16 *kilobits*. Since there are eight bits in a byte, it takes eight 16K RAM chips to store 16 kilobytes, commonly referred to as "16K." This alone would inflate your cost estimate by a factor of eight. Instead of $250 for 2000K, you'd be paying $2000.

There are other considerations as well. You can't just wire up a few rows of RAM chips on a circuit board and plug them into a computer. You'd need additional chips to control the RAM chips, plus miscellaneous support circuitry (including a system for power-refreshing, required by dynamic RAM chips many times per second). Everything would have to be designed to interface flawlessly with the computer's hardware. Finally, you'd have to write a sophisticated machine language program to link with the computer's operating system so the RAM disk would be recognized as a storage device. Obviously, it's a job best left to engineers and advanced programmers.

There have been some products advertised for the 64 and VIC which add additional memory through bank switching. These memory expanders add 64K to a 64, but only one bank of 8K is available at any time. They're not exactly RAM disks, but they give you additional space for storing data. And you still need to save programs on tape or disk.

If what you're looking for is a faster, cheaper, and more reliable alternative to floppy disk drives, you probably won't have to wait for long. In the next few years, we can expect to see better systems for mass storage. Hard disks, formerly affordable only by businesses and well-heeled hobbyists, are becoming cheaper every day. We've seen some ten-megabyte (10,000K) hard disks for the IBM PC advertised for as low as $795.

Ten megabytes is the equivalent of 64 floppy disks on a Commodore 1541 drive, and hard disks are so fast that you might mistake them for RAM disks. Although $795 might seem like a lot of money compared to the price of a 1541, it's not really much more than what ordinary floppy disk drives cost a few years ago. Soon we may see them for $500 or less, and marketed for home computers as well as high-end personal and business computers. And laser disks, now used mainly for audio and video recordings, are a promising possibility.

You can also expect floppy disk drives to continue improving in terms of reliability, storage capacity, and cost effectiveness.

The use of battery-powered (or bubble memory) RAM disks for mass storage purposes will probably be limited to portable computers. Predictions in this industry are risky, of course, but it seems likely that magnetic and optical media will remain cheaper in terms of kilobytes per dollar than electronic circuitry.

Q. I have a question about the *SpeedScript* word processor published in COMPUTE!'s GAZETTE. When you are programming in BASIC on a Commodore 64, the screen says there are 38911 bytes of memory available. When you're using *SpeedScript*, however, you have 45824 bytes available for text. How can you have more room for text than usable memory?

A. You *can't* have more room for text than usable memory, of course. The answer is that the Commodore 64 has more than 38911 bytes of usable memory. The catch is that not all of it is available in BASIC.

Remember that the Commodore 64, as the name implies, has 64K of RAM. It also has 20K of ROM (Read Only Memory). The ROM is permanent memory which holds the operating system (8K), the BASIC interpreter (8K), and the character generator (4K). All together, that's a total of 84K of RAM and ROM.

The problem is that the microprocessor chip which is the central brain of the Commodore 64 cannot address, or "see," more than 64K of memory at a time. To get around this limitation, the Commodore 64 designers layered the ROM atop some of the RAM. This masks out 20K of RAM. After additional RAM is subtracted for things like screen memory and other overhead, only 38911 bytes remain available for BASIC programming.

If you're writing a BASIC program, the operating system has to use BASIC ROM to understand and interpret the program. It's possible to switch out the ROM to get to the RAM underneath, effectively disconnecting the computer's BASIC brain, but without a brain it wouldn't recognize anything you typed. That's why the bank switching technique is used primarily by machine language programmers.

Because *SpeedScript* is written entirely in machine language, not in BASIC, it can take advantage of some of this "invisible" RAM hidden beneath the ROM. It switches off BASIC completely, freeing 8K of extra RAM for text (plus the 4K starting at location 49152), leaving a total of about 45K. Many other programs use this technique, too.

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Using Variables In 1985

To begin with, variables work the same in 1985 as they did in 1984. But since it's January, let's start off with a New Year's resolution. My resolution is that I'm going to show you how to use variables in BASIC programs—and your resolution is to learn how variables work. Is that a deal? Let's get started. We've got the whole year ahead of us.

Uses Of Variables	Short Examples To Try
Calculation	10 A=100:B=20:PRINTA"TIMES"B"="A*B
Formulas	10 RATE=.12:LOAN=80000:PRINTRATE*LOAN
Random Numbers	10 X=INT(10*RND(1)+1):PRINTX:GOTO10
FOR-NEXT/Repeat Action	10 FORB=1TO9:PRINT"REPEAT ACTION 9 TIMES":NEXTB
FOR-NEXT/Time Delay	10 PRINT"WAIT":FORT=1TO1500: NEXT:PRINT"CONTINUE"
INPUT Statements	10 PRINT"YOUR NAME";:INPUTN$:PRINT"HI,"N$
Abbreviate Long Info.	10 A$="FREQUENTLY USED LONG MESSAGE":PRINTA$
Editing Commands	10 C$="{CLR}":PRINTC$
Colors	10 BK$="{BLACK}":PRINTBK$"THIS PRINTS BLACK NOW"
String Functions	10 X$="YESNO":PRINTLEFT$(X$,3): PRINTRIGHT$(X$,2)
Check The Keyboard	10 GETK$:IFK$=""THEN10 20 PRINT"PROGRAM CONTINUES WHEN YOU PRESS A KEY"

The XYZ's Of Variables

Variables put more "magic" in BASIC programs than any other technique. Some discussions of variables talk about memory locations or algebra, but I like to use a simpler approach. Type the following line and then press RETURN:

```
A=5:PRINTA
```

There are two commands in this line. The first command (A=5) tells the computer that from now on, the letter A is the same as the number 5. The second command (PRINTA) tells the computer to print the variable A on the screen, and since A equals 5, the computer responds by printing the number 5.

Notice that when we PRINT a variable, it's always OUTSIDE quotation marks. It might help to think of a variable as a "stand-in" or "substitute." We can use variables to stand for numbers, formulas, letters, words, sentences, graphic symbols, color commands, POKE numbers, editing commands, and more.

Here's a short program showing another way to use variables (enter these lines as shown and be sure to press RETURN at the end of each line):

```
10 B$="BASIC MAGIC IS FUN!"
20 PRINTB$
```

Type RUN and press RETURN. The computer prints the sentence: BASIC MAGIC IS FUN! Why? Well line 10 tells the computer that the variable B$ stands for everything inside the quotation marks—in this case, a whole sentence. So when we tell the computer to PRINT B$ in line 20, the computer prints the sentence.

As we've seen in our opening examples, there are two types of variables: *numeric variables* and *string variables.*

Numeric variables are used to stand for *number values* used in calculations and formulas. A numeric variable name can be any letter of the alphabet, two letters, or a letter and a number. Here are some examples of numeric variables:

A, AB, A1, B2, XY

String variables can be used to stand for anything which is normally put inside quotation marks in a BASIC program—letters, words, sentences, graphics symbols, color commands, screen editing commands, and more. The only difference in appearance between string variables and numeric variables is that string variables have a dollar sign ($) at the end. Here are some examples:

A$, AB$, A1$, B2$, XY$

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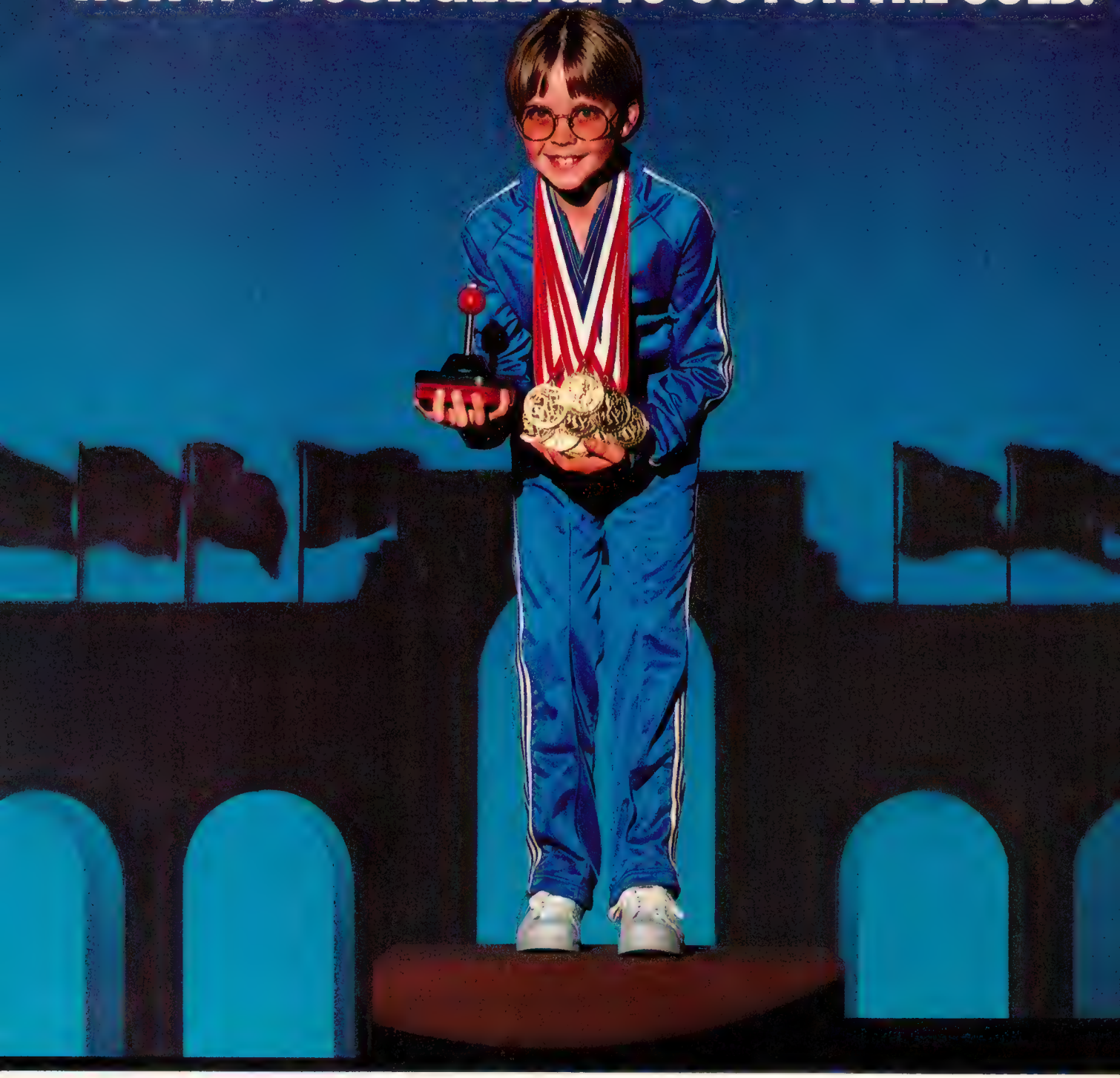

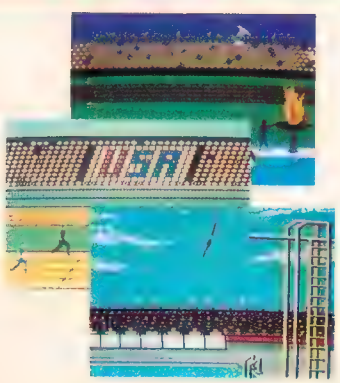

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REM: *Some BASIC statements, like ST, cannot be used as variables. Some of the letter combinations which are "reserved" by the computer for use as BASIC statements are: IF, OR, ST, GO, TO, TI, and TI$. If you try to use these as variables, the computer will give you a SYNTAX ERROR message. Do not use variables which contain keywords...for example, you can use MO as a variable but MOR won't work because it contains the keyword OR.*

It's possible to use complete words like RATE and RATE$ as variables, although I recommend that you use one- or two-character variables rather than complete words like RATE$. The problem is, the computer will accept a long variable name like RATE, but it only "sees" the FIRST TWO LETTERS. So if you name a variable RATE or RATE$ the computer only reads RA or RA$, which means you can get into trouble if you try to define two variables like RATE and RANGER. The computer will think they're both the same (RA).

Using Numeric Variables

You can use numeric variables just like numbers. This is important because this feature lets you *change* the variable by adding to it or subtracting, multiplying or dividing it. To show you how this works, type NEW and press RETURN, then enter this short program and run it:

```
10 X=1
20 PRINTX
30 X=X+4
40 PRINTX
```

The computer prints two numbers: first the number 1, and then the number 5. And it uses the same variable (X) to do it. The trick is that we *changed* the value of X. Here's how it works:

Line 10 defines X as the number 1.

Line 20 prints the value of X, which is 1.

Line 30 *adds* 4 to the old value of X, so that the *new value* of X becomes 5. In other words, X=X+4 is the same as saying X=1+4 and 1+4 equals 5 so X=5 and 5 becomes the new value of X. It's important to remember that the new value is always to the left of the equals sign. Anything to the right is the old value. So, for example, X=X+X means the new value is the old value plus the old value. In other words, it's doubled.

Line 40 prints the last value of X, which was 5, and from now on unless you change the value of X again, X stands for the number 5.

Got that? Let's consider a few more examples. The key is line 30. If we said in line 30 that X=X+20, then the new value of X would be 21. We could also change the old value of X by multiplying it by some number. For example, if we put X=X*12 in line 30, the new value of X would be 1*12 which is 12. And if we wanted, we could change the value by subtracting, dividing, or even multiplying X by a percentage or bank interest rate—that's how "business" programs work. They use variables to help calculate various formulas, like interest rates.

Type NEW and press RETURN, then enter and run this program:

```
10 PRINT"ENTER DOLLAR AMOUNT":INPUTC
20 PRINT"ENTER AN ANNUAL INTEREST RATE (U
   SE .12 FOR 12 PERCENT)":INPUTR
30 PRINT"$"C"TIMES"R"EQUALS"C*R
```

Type NEW and press RETURN, then enter this program:

```
10 X=1
20 PRINTX
30 X=X+1
40 FORT=1TO200:NEXT:GOTO20
```

To stop the program, hold down the RUN/STOP key and press RESTORE at the same time, then type LIST and press RETURN to see the program. Do you see how this program uses the variable X to "count"? Here's how it works:

Line 10 defines X as the number 1. Now when the computer sees X it interprets it as the number 1. But we can also *change* the value of X—and we're going to do that in a moment.

Line 20 prints the value of X, which is 1, so the computer displays the number 1 on the screen.

Line 30 adds 1 to the value of X, which makes it 2. In other words X=X+1 is the same as X=1+1 or X=2. So the *new value of X is 2.*

Line 40 starts off with a FOR–NEXT time delay loop which tells the computer to pause and "count" to 200 before going on (computers count fast). GOTO20 tells the computer to jump back up to line 20 and print X. The computer prints the most current value of X, which is now 2.

The program keeps going to line 30, where it adds 1 to the value of X. Except this time X equals 2, so X=X+1 is the same as X=2+1 or X=3, and the new value of X is 3. The program loops through line 40 to line 20 again and prints the new value of X which is now 3.

We'll show you some more sophisticated uses for numeric variables further on, but first let's take a look at how string variables work.

Here's a short program which uses numeric variables to "count" through the screen colors—notice the numeric variables SC and T:

Commodore 64 Version:

```
10 FORSC=0TO15:POKE53281,SC:FORT=1TO1000:
   NEXTT:NEXTSC
```

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VIC-20 Version:

```
10 FORSC=1TO255:POKE36879,SC:FORT=1TO1000
   :NEXTT:NEXTSC
```

Plus/4 and Commodore 16 Version:

```
10 FORSC=1TO255:COLOR0,SC,7:FORT=1TO1000:
   NEXTT:NEXTSC
```

This line defines SC as a range of numbers from 0 to 15 (or 1 to 255). Then we use a POKE (or COLOR) command to change the color of the screen—the colors will be displayed in order from 0 to 15 (or 1 to 255). Then comes a time delay to slow things down, and finally the NEXT command which wraps up the FOR–NEXT loop.

Using String Variables

Did you ever look at a long program in a computer magazine and get confused by all those letters and dollar signs? In BASIC, anything followed by a dollar sign is a *string variable* and it's really not so confusing if you know how to read it. The only exception is if the dollar sign is inside quotation marks, in which case you're either printing the character ($) or using it as part of a string. The three-line interest rate program above is an example of this.

The key to interpreting string variables in a new program you haven't seen before is to look for any "definitions" in the program, such as D$="{10 DOWN}" or C$="{CLR}". In this example, D$ is used to stand for 10 cursor commands ({10 DOWN} means press the CRSR DOWN key 10 times) and C$ is used to *clear the screen* ({CLR} means hold down the SHIFT key and press the CLR/HOME key). Type NEW to erase your previous program, then enter and run this example:

```
10 C$="{CLR}":D$="{10 DOWN}"
20 PRINTC$D$"NOW WE CAN USE...":FORT=1TO5
   00:NEXT
30 PRINTC$D$"OUR VARIABLES EASILY...":FOR
   T=1TO500:NEXT
40 PRINTC$D$"TO POSITION OUR MESSAGE.":FO
   RT=1TO500:NEXT
```

Using variables to stand for editing commands is a common use of string variables. This is not only convenient but it also saves some memory if you're trying to "crunch" your program to keep it small and manageable. You can use string variables to stand for colors, cursor movements, insert and delete functions, clearing the screen, HOMEing the cursor, and more.

You can also use string variables to stand for a graphics symbol, or even a "string" of symbols. Type NEW and press RETURN, then enter this example:

```
10 C$="{CLR}":L$="CCCCCCCCCCCCCCCCCCCCC"
20 PRINTC$L$
```

In line 10, C$ is defined as the *clear screen* command and L$ is defined as a string of graphic "line" symbols. Now, whenever you PRINTC$, you'll clear the screen, and whenever you PRINTL$, you'll draw a line across the screen. In our example, we put both variables together.

One of the most common and important uses of string variables is the INPUT statement. If you type INPUT followed by *any* variable, the computer displays a question mark on the screen and waits until you type something; when you press the RETURN key, whatever you typed gets assigned to the INPUT variable. We've already used some short examples in this column so here's a longer version:

```
10 PRINTCHR$(147)"ENTER A LOAN AMOUNT AND
    PRESS RETURN (USE 80000 FOR";
20 PRINT" $80,000...DO NOT TYPE $ OR COMM
   AS)":INPUTL
30 PRINT:PRINT"ENTER AN INTEREST RATE AND
    PRESS RETURN (USE .12 FOR";
40 PRINT" 12 PERCENT)":INPUTR
50 PRINTCHR$(147)"THE ANNUAL INTEREST ON"
   L" AT"(R*100)" PERCENT IS $"(R*L)
60 PRINT"{HOME}"TAB(242)"PRESS ANY KEY TO
    CONTINUE."
70 GETK$:IFK$=""THEN70
80 GOTO10
```

Line 10 uses the PRINT statement to clear the screen, then displays a *prompt message* (inside quotation marks) with instructions to the user. It's not absolutely necessary to include a prompt, but it helps a lot. If you used only INPUT statements, the user might not know to type in a number, seeing only a question mark and a blinking cursor. The semicolon ties this PRINT message to the next PRINT message in line 20 so the two PRINT statements are displayed as one continuous line. Semicolons in BASIC are sort of like super glue.

Line 20 continues the message begun in line 10. We could use the superglue semicolon (;) again, to put the INPUT question mark at the end of the PRINT message. But we left it out, because VIC-20s have a quirk which doesn't allow input prompts longer than 22 characters (one line). We didn't use the semicolon, so the INPUT question mark appears on the next line down. The INPUT command tells the computer to wait for an entry and assigns the variable L to the number you typed in—we're using L to stand for "Loan."

Line 30 starts with a PRINT command all by itself—this puts a blank horizontal line on the screen to put some "space" between our messages. Next, we have another prompt message inside quotation marks. Prompt messages tell the person using your program exactly what they should do next. Again, our message "spills over" to the next line, so we use a semicolon at the end

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of the first part to tie things together.

Line 40 finishes the message, waits for the interest rate to be INPUT, and assigns the variable R to it.

Line 50 clears the screen and prints a message which contains the words of the message inside quotation marks, the INPUT variables which display the numbers you typed in as L (loan amount) and R (interest rate). The calculation (R*100) converts the decimal interest rate into a whole number—for example, if R is .12 this calculation makes it 12 so we can say "12 percent" in our message. The formula (R*L) at the end of the message multiplies the two variables to automatically give the result. If L is 80000 and R is .12 the result is 9600.

Line 60 goes to the "home" position and TABs across 242 spaces, then prints a prompt message.

Line 70 checks the keyboard to see if any key was pressed. This line keeps going back to itself if no key is pressed. As soon as a key is pressed, the computer drops down to the next line which tells it to GOTO the beginning of the program and do it over again.

Let's take a quick look at another use of a string variable: the GET$ function.

Using GETK$ To Check For Any Key

The GET command uses a string variable to identify a key from your computer's keyboard, so you can tell in a BASIC program which key a user is pressing. I like to use the variable K$ to stand for "key." Try this short program:

```
10 PRINTCHR$(147):PRINT"PRESS ANY KEY TO
   {SPACE}START"
20 GETK$:IFK$=""THENGOTO20
30 PRINT"I'M A SMART COMPUTER.{2 SPACES}I
    KNOW WHAT KEY YOU TYPE.{2 SPACES}TYPE
    A KEY."
40 GETK$:IFK$=""THEN40
50 PRINT"THE KEY YOU TYPED IS "K$
60 FORT=1TO1000:NEXT:GOTO10
```

Since we're going to devote a future column to GETting and PEEKing the keyboard, we'll make this a short explanation. The "key" lines in this program are line 20 and line 40. In both of these lines, we tell the computer to GET a key from the keyboard. We're using the variable K$, although you could use any string variable here. The IF- THEN statement in these lines tells the computer that if K$ equals *nothing* (two quotation marks "" side by side mean "nothing" in this use), then keep going back to the same line to check the keyboard. As soon as a key—any key—is pressed, this line stops going back to itself and the program continues. K$ now stands for the key you pressed in line 40, so in line 50 we can actually PRINTK$ and the computer will display the character on the key you pressed. Any key including SHIFTed characters will be detected.

LEFT$, MID$, And RIGHT$

These three commands are seldom discussed in BASIC tutorials but can be very useful. Here's how they work. If you put a long group of characters, words, color commands, or other information inside quotation marks, these "string functions" let you pull out virtually any character or group of characters from the group. We'll use the following program as an example:

```
10 W$="YESNOMAYBE"
20 PRINTLEFT$(W$,3)
30 PRINTRIGHT$(W$,5)
40 PRINTMID$(W$,4,2)
```

Line 10 defines the string variable W$ as a group of letters in quotation marks which form the words YES, NO, and MAYBE.

Line 20 uses the LEFT$ command to print the first three characters which form the word "YES." Notice the format inside the parentheses. First comes the variable, then a comma, then *how many characters counting from the left side* you want to use—in this case we took the first three letters. You tell the computer to start at the left of string variable W$, and pick out three letters.

Line 30 works just like line 20, except this time we print the five characters counting from the *right* side, forming the word "MAYBE."

Line 40 works similarly to lines 20 and 30. The MID$ command requires an extra number in parentheses. The number 4 in parentheses tells the computer to *count four characters* from the left side of the string. The number 2 *selects* two characters—in this case, the fourth and fifth characters, which are the letters N and O. If you want to experiment, try using MID$ instead of RIGHT$ to get the word MAYBE in line 30. (Hint: Change the two numbers in parentheses to 6 and 5.)

There are many, many other ways to use variables—for example, we haven't even covered random numbers yet, or how the computer calculates numbers. We'll explore these "magical" topics and much more in the coming months—and keep our New Year's resolution to learn more about variables and how they work.

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HORIZONS

Charles Brannon
Program Editor

This is the first installment of the new Commodore column for both the VIC and the 64. Because of the cancellation of "VICreations," we've decided to cover both machines in what was formerly "Horizons: 64". As the new Commodore 16 and Plus/4 computers arrive on the market, we'll cover them here, too. The nature and style of this column will not change unless you, the reader, want to make recommendations. The column will try not to slight any machine for the benefit of another, but the 64 must get the attention it deserves.

A hardware item reviewed here (such as a printer or interface) can be applicable to both machines. Software reviewed here for the 64 is sometimes available in a VIC-20 version.

End Of An Era

The VIC-20 is in its sunset days. It has been and still is a good value for the money, but even better price/performance buys are becoming available (such as the Commodore 16). Commodore is no longer manufacturing the VIC-20, but there are thousands of under-$100 VICs still available in stores and warehouses. New hardware and software for the VIC is becoming hard to find. In fact, almost every major software publisher has discontinued its VIC product line.

Nevertheless, many people have made quite an investment in the VIC—it originally sold for $299. A theoretical VIC-20 system could have an 80-column display cartridge, 32K of memory, several disk drives, a high-quality printer, not to mention joysticks, light pens, a color monitor, and perhaps $1000 in software. Even though the VIC-20 is no longer a current product, there's still an active and enthusiastic VIC audience out there.

VIC owners should remember that for less than $200 they can add a Commodore 64 to their system, cheaper than some fully expanded VIC motherboards. The 64 can use most VIC-20 peripherals, such as the 1541 (but not the earlier 1540) disk drive, any color monitor, Commodore-compatible printers and printer interfaces, a Datassette, and game peripherals. Even some VIC software will work on the 64. There's no good reason (except financially) that you can't own and use *two* computers. That way you don't lose the investment you've made in VIC-20 software, plus you gain access to a new (and more powerful) software library. The new Commodore 16 and Plus/4 can also use many VIC and 64 peripherals. If at least all peripherals could be guaranteed compatible with future models, it would not be considered financially reckless to upgrade just your computer console. Your peripherals will always end up costing more than the computer.

VIC And 64 Reunion

If you do own both a VIC and a 64, you've probably realized that both machines cannot share a disk drive or printer. Each machine must have complete control of the serial bus. With two controllers (computers) vying for priority, all the peripherals get quite confused. Usually the whole system crashes.

You can use both a VIC and 64 simultaneously as long as you unplug the serial cable from the computer not currently needing access to peripherals. If you have a Commodore color monitor, the VIC can be attached to the front connections, and the 64 to the rear ones. A flip of a switch is all that is necessary to change your display from the VIC to the 64, or vice versa. But not only is it inconvenient to change cables, it can also sometimes reset the computer (wiping out anything in memory), and even damage your computer or peripherals. You should never plug in or remove any cables or cartridges with the power on (some people won't even plug in a joy-

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stick with the power on, though I've never found this to be a problem).

The Reunion is a small black box that solves this problem. Simply plug the cables from the box into both a VIC and a 64. Your standard serial cable plugs into the rear of the box, which is then connected to the first peripheral in the chain. Both computers cannot access the serial bus simultaneously, but with a push-button toggle switch you can easily alternate between the VIC and 64. We've used the box here when translating programs. The original program can run on one machine for comparison while you are working on the translation.

When I developed the VIC version of *SpeedScript*, I simply switched cables. I translated the source code and assembled it on the 64, then saved the object code to disk. When I wanted to test the VIC version, I would switch cables, load the program into the VIC, and test it. My source code was safe on the 64, so if the VIC crashed, I didn't need to go through the laborious process of reloading the assembler, my utilities, and the source code. It also reduced the number of times I had to save my source code. The Reunion would have been quite handy, and I wouldn't have had to fear losing any programming when I switched cables.

Incidentally, it would at first appear that you could simply plug a cable between the VIC and 64 to permit them to directly communicate with each other over the serial bus. But what device number would you use? As it turns out, that's a dumb question, since a controller does not have a device number. Both machines are trying to control each other, and neither will give in. That's the problem with an intelligent bus. The RS-232 (modem) port, however, is not considered an intelligent bus. We've used a null modem cable (a cable which directly connects two RS-232 ports, obviating the need for modems and telephones) to let the VIC and 64 talk directly to each other at high speed. Another possibility is using the parallel user port (which is the same physical port as the RS-232 port, but can be reprogrammed to act as a simple parallel port).

Speed Up Your System

Two new products from Skyles Electrical Works can significantly amplify the power of your 64. *Blitz!* is a BASIC compiler that translates almost any Commodore 64 BASIC program into P-code, a compiler language much faster than BASIC. *1541 Flash!* is a hardware modification that transparently drives your 1541 at three times normal speed (or 300%, which *sounds* even faster). *Blitz!*, therefore, effectively speeds up your computer, and *1541 Flash!* speeds up the disk drive. Both of these products are excellent.

The *Blitz!* BASIC compiler is a dream come true for BASIC programmers. BASIC is easy to learn and use, but is much slower than machine language. You can write almost any program in BASIC, but games tend to be sluggish, business programs take lengthy siestas during sorts and searches, and utilities take forever to read a disk file. Machine language, of course, can be a thousand times faster than BASIC, but since each ML command does so little, great attention to detail is necessary. It can be a painstaking task to set up something in machine language which could be accomplished in a few lines of BASIC. On the other hand, machine language is great for repetitive tasks like filling the 1000 locations of color memory.

Compiling a program with *Blitz!* is easy. Just save your BASIC program to a disk with at least 300 blocks free. Load and run *Blitz!*, give it the filename, and after a few minutes you can load and run the compiled program. *Blitz!* works best with two drives or a dual drive, permitting you to compile more than one program at a time, but will run quite nicely with a single drive.

There are few limitations on your BASIC program. Any program that runs in Commodore 64 BASIC will compile, unlike some compilers that require you to limit yourself to a subset of BASIC. You rarely have to make any changes to your program to make it compile. *Blitz!* is not available in a VIC version, and cannot compile a VIC-20 program to run on the VIC.

Blitz! can also compile programs written in extended BASIC languages like *Simon's BASIC*, *Super Expander*, and *VicTree*. Everything but the extended commands is compiled. The added commands are passed on to the resident language during run time.

We compiled several BASIC games including "Hardhat Climber" (published in the January 1984 issue of the GAZETTE). Hardhat Climber is a good example of a playable all-BASIC arcade game. The speed is a tad slow for real arcade nuts, but fast enough to be exciting. Your man moves at about the same rate that the cursor blinks. Well, after the game was compiled, the little man fairly zoomed across the screen, running as if he were a repeating cursor (he ran so fast he kept falling off the edge of the girders). The barrels did not leisurely roll, but raced like a truck going down a grade with no brakes. In fact, the game was unplayable at this speed. The difference was as remarkable as an LP album played at 78 rpm. Just a nudge of the joystick sent the climber halfway across the screen. Ironically, this BASIC game would have to be slowed down to be playable when compiled.

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Blitz! does not convert your program directly into machine language. Instead, it translates BASIC statements into a high-speed language called *P-code*. P-code is executed by a P-code *engine* written in machine language. This interpreter, 6K in length, is tagged onto the compiled program. Therefore, you can run a compiled program on any 64 without the compiler. The extra memory used by the interpreter is not a real encumbrance, since the compiled program is typically reduced to 60% of the size of the original BASIC program.

How fast is *Blitz!*? The program listed at the end of the column is a simple bubble sort that alphabetizes 100 three-character strings. (If you've wondered about how to alphabetize a list, look at lines 140–160. There are much faster ways to sort, but this is one of the simplest.)

I think a sort makes a good *benchmark* (a program used to evaluate a system) since it is a practical application. The sort shown below uses a variety of BASIC statements and features, including comparisons (IF/THEN), calculations, variable assignments, and strings. It's also very easy to tell if the program runs correctly. The program automatically reports how long it took to sort the list. We ran the program through *Blitz!* with no problems. It took 1 minute and 32 seconds to compile.

Running in BASIC, the sort takes 119 seconds. When *Blitz!*'ed, the string sort runs in 27 seconds. A simple calculation shows that the program runs 4.4 times faster. I then changed the string array to an integer array, thinking that working with two-byte integers must be faster than three-character strings. To my surprise, the BASIC integer sort was actually slower than the BASIC string sort, running in 133 seconds. However, the compiled integer sort ran 4.75 times faster than its BASIC counterpart, with a speed of 28 seconds. Just like BASIC, the compiler is slower sorting integers than strings, but can speed up the use of integers more radically than the use of strings.

In addition to faster program execution, *Blitz!* gives you several features not supported by Commodore BASIC. First, you can chain to another program without losing any variables, and the second program doesn't have to be smaller than the first (a limitation of BASIC's normal chaining process). *Blitz!* also treats integer variables (those with a % sign following the variable name) specially. Normally, BASIC converts an integer to floating point, does the calculation, then converts the result back into an integer, which slows down integer calculations. But *Blitz!* performs all integer calculations with special integer math routines, which run much faster than floating point calculations. It's also legal to use integer variables as the index of a FOR–NEXT loop. Unlike some compilers, though, *Blitz!* fully supports floating-point operations.

You should note that before compiling, the BASIC program should be tested and debugged. *Blitz!* makes programs which run faster, and if there are bugs in the original, there will be even faster bugs in the compiled program.

Blitz! is a fine program, but the manual leaves something to be desired. Only 23 pages, the documentation barely covers all the features of *Blitz!*, and may be confusing to novice programmers. A compiler, being a language system, deserves more than 23 pages. On the other hand, compiling a program is so easy you almost don't need a manual, but a longer manual could afford to be tutorial in style for the sake of beginners, with details for the more advanced programmer.

A testament to *Blitz!*'s power can be found in several commercial programs. LIST them, and all you see is the word BLITZ!. Obviously, these programs were written in BASIC, compiled with *Blitz!*, and became fast enough to be commercially successful. In fact, Skyles Electrical Works does not charge a royalty or license fee for use of your compiled programs (even though 6K of the compiled program is the *Blitz!* runtime package). If you do distribute a program compiled by *Blitz!*, Skyles merely requests that you give *Blitz!* credit in your program or documentation, along with the address of Skyles Electrical Works.

Warp Drive Revisited

In the November column, I mentioned a software product called *Kwik-Load* that speeds up 1541 program LOADs by 300%. As software, *Kwik-Load* is vulnerable, often wiped out or crashed by other programs. The idea is a good one, but only a hardware modification could be truly fast, yet transparent to most software. (*Transparent* means that a program or system does not interfere with any other program. Moreover, a truly transparent system is invisible to all other programs, as the name implies. Some printer interfaces transparently emulate a Commodore printer, simulating all the commands and modes of a Commodore printer on a non-Commodore printer.) Of course, *Kwik-Load* only costs $19.95, cheaper than almost any hardware product.

1541 Flash! is a set of parts and instructions to modify both your computer and disk drive to boost the effective speed of disk transfer by three times. Unfortunately, a hardware modification is more difficult than merely loading and running a program, or inserting a cartridge. *1541 Flash!* consists of a piggyback module that wedges into the

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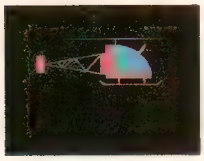

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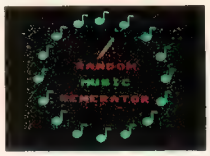

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Kernal ROM, a replacement DOS ROM for the 1541, and an interface cartridge (called the CableCard) and cable that attaches the modem port to a chip within the disk drive.

Performing the upgrade is not trivial, but at least no electronics expertise or soldering is needed. Anyone with a steady hand and attention for detail can install *1541 Flash!*. The manual says it should take about 30 minutes. It took me about 15 minutes, since I've done similar things before. Utmost care is needed, though, since you really can damage both your computer and drive if you are reckless.

You need to open the case of both your computer and drive to get at their innards—not a task for the squeamish or those who wish to preserve their 90-day warranty, since the upgrade is more or less permanent. (Though we've been told that Commodore does not check for hardware modifications on warranty returns. They merely check to see if the computer works, and if not, they send you a new one.)

You first have to find the Kernal ROM in your 64, marked with one of three part numbers. The manual includes pictures and diagrams to help you identify the correct chips to replace. The Kernal ROM is removed, then inserted into a socket on a tiny board. You then plug the board into the empty ROM socket. The board contains a modified version of the Kernal. With both ROMs on board, you can choose either the normal or enhanced Kernal by flicking a switch on the interface card.

The biggest problem here is that many 64s do not have socketed ROM chips; they're soldered directly to the board (it saves Commodore a little on manufacturing costs, but makes it difficult to replace faulty chips). We asked Skyles about this, and they estimate from 10 to 20 percent of all 64s do not have socketed ROM chips. Whether or not your machine has socketed chips does not seem to correlate to when it was manufactured, or what serial number it has. I had to open three 64s before I found one with socketed ROM chips. You can mail your computer to Skyles along with $28.50 and they'll install the necessary socket. It could take a couple of weeks for turnaround, though. Skyles encourages their dealers to install a socket for you, or to send your 64 to Commodore for the modification. Many dealers will install *1541 Flash!* for you for about $10 extra.

Wires leading from the Kernal module lead out through the modem port, which then plug into the CableCard, a small cartridge plugged into the modem port. The cartridge includes another modem port so that you don't lose the use of a modem or RS-232 interface.

Inside the disk drive, you remove the disk operating system ROM and replace it with a new one. As long as you don't bend any of the tiny pins on the ROMs, it's not too hard to pry them out with a thin-blade screwdriver. On my 1541, I had to use a $1 chip extractor rather than a screwdriver, since you can't lever the screwdriver against the board without mashing some capacitors.

The trickiest part is that you must locate one 6522 chip (there are two of them), then remove it. It's much harder to remove a long chip like the 6522 without damaging any pins. I bent several pins, but was able to ease them all back into place without breaking any. After the chip is out, you purposely bend one pin at a 90-degree angle, then re-insert the chip. Once you've bent the pin, you can't reverse the procedure without snapping off the delicate pin. A white microclip attaches to the bent pin, and a black one to an adjacent pin. You also screw down a grounding lug. This cable is then threaded out the back of the drive and attached to the modem port cartridge.

Once you've sweated over these crucial maneuvers, you're rewarded for your effort with a significant upgrade in speed. It really works. All disk read access is three times faster. The speedup works with almost every program I tried. After some tests, I found that writing to a disk is only about twice as fast. After checking with Skyles, they confirmed that writing to a disk is only 1.8 times as fast. Almost all commercial software will load from twice to three times normal speed. I said *almost* all, but of three Epyx games I tried, none of them would load with the *1541 Flash!* installed—probably related to the copy-protection employed by Epyx. With a POKE and a command to the drive, you can turn off the speedup, but even with this, I couldn't get the Epyx games to load. So beware, this modification is almost impossible to reverse.

The enhanced ROM also adds a few features to your 64. The routines that support the extra features take the place of the cassette output routines, since you probably won't use your cassette as much when you have a disk drive. With the *1541 Flash!* ROM enabled, you can load a cassette program, but not save one to cassette. You can load a tape program and save it to disk, though, and you can always switch back in the normal 64 ROM if you need full access to the tape drive.

The DOS wedge is built into ROM, and you can activate it at any time with SYS 65526. LOAD, SAVE, and VERIFY default to the disk drive, rather than the cassette. (You don't need to add the ,8.) Several new editing keys have been added. CTRL–back arrow flicks the cursor to the bottom of the screen. Holding down the

LOST.

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Commodore key and the back arrow tabs the cursor to position 15 (a 16-character tab). Commodore key-up arrow lets you toggle in and out of quote mode without typing any quotes. CTRL still is used to slow down scrolling, but you can now freeze a scrolling screen with the SHIFT key, or keep it frozen with SHIFT LOCK. Letting up on these keys resumes the listing. You can wipe out the line the cursor is on with Commodore–INST/DEL, and erase the screen from the line the cursor is on to the end of the screen with Commodore–CLR/HOME.

The manual includes documentation on several new high-speed disk commands for use by machine language programmers. You can set the drive up to continually spool sectors. You don't have to request a track and sector—your program merely needs to read continuously. By taking advantage of these new direct-access disk commands, you could get even more speed out of the 1541.

Having used *1541 Flash!* for several days, already I can't bear to go back to a slow 1541. It's amazing how quickly you can get spoiled by a luxury like this. More than a few editors here have cast covetous eyes on the upgraded 64/1541. And the price is reasonable for such a dramatic enhancement. After reading the installation description above, you can decide if you're up to opening your equipment, yanking out chips, and enjoying a 300% speedup.

The Reunion
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$89.95 for 1541 Flash!

String Sort Program

```
100 A=RND(-1):REM FORCE ALL RUNS TO USE S
    AME RANDOM SEQUENCE
110 DIM A$(100):PRINTCHR$(147)"GENERATING
     STRING DATA"
120 FORI=0TO99:A$(I)=CHR$(65+26*RND(1))+C
    HR$(65+26*RND(1))+CHR$(65+26*RND(1))

130 NEXT:PRINT"NOW SORTING":T=TI
140 EX=0
150 FORI=0TO98:IFA$(I)>A$(I+1)THENT$=A$(I
    ):A$(I)=A$(I+1):A$(I+1)=T$:EX=1

160 NEXT:IFEXTHEN140
170 PRINT"SORT FINISHED IN";(TI-T)/60;"SE
    CONDS.":PRINT
180 FORI=0TO99:PRINTA$(I);" ";:NEXT
```


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Double Duty Variables

William A. Yarberry, Jr.

If you've discovered a clever timesaving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'s GAZETTE. If we use it, we'll pay you $35. Due to the volume of items submitted, we regret that we cannot always reply individually to submissions.

No matter how much memory your computer has, there are times when it's inadequate for your purposes. There's a sort of universal law: Programs grow to fill all free memory (plus a little more).

Here's an old programming trick which can be adapted very easily to the VIC or 64. The idea is to crunch two or more variables into one, making the variable do double duty.

Variables And Memory

When a value is assigned to a variable (X=5, for example), it takes memory. And no matter what the value is, it takes the same amount of memory. Try this experiment:

```
CLR: PRINT FRE(0): X=1: PRINT FRE(0)
```

Since the Commodore 64 gives negative numbers when there's more than 32K available, you can change FRE(0) to FRE(0)+65536 to get a positive answer.

Type the above line and press RETURN. Type CLR (don't press the CLR/HOME key), to clear out variables from memory. The amount of free memory is printed. A value is given to variable X, and the free memory is printed again. Note that the variable has occupied seven bytes. Two are used for the variable name, five for the value.

On a new line, type the same line again, changing X=1 to something like X=999999. Press RETURN again and what happens? The same amount of memory is used. No matter how big or small the value, the same memory is used (five bytes). And no matter how long the name of the variable (try XABCDE=999999), two bytes are used for the name.

Variable arrays act almost the same. A number in a floating point array, like the variable X above, uses five bytes for each value. But there's only one name and it uses seven bytes (only once). So, for example, dimensioning an array Q with DIM Q(20) takes five bytes for each of the 21 elements (0 through 20), a total of 105, plus seven for the name. Thus, it requires 112 bytes.

Doubling Up

Now let's imagine a simple data base program. You swim every morning and want to keep track of how many laps you've covered. The program you write has two arrays, D(I) for the date and L(I) for number of laps that day. It doesn't matter in this example whether the data is stored on tape or disk, or read from DATA statements.

After 50 swimming sessions, the two arrays will use up 262 bytes each, for a total of 524. It might be years until memory is a problem. Even on an unexpanded VIC, it would take a year of swimming before free memory dwindled to nothing.

But you decide to expand your program. Perhaps you want to print out a bar graph, or you add the time (to get a daily swimming speed and overall average). Or you have five friends who want their laps and times added. As the program grows, you find yourself running out of memory.

One solution is to double up on variables. The date you input is always between 101 (January 1) and 1231 (December 31). And the number of laps always ranges from 0 to 999. So, when you input the date and time, combine the two numbers into a single variable. Multiply the date

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by 1000 and add the laps.

Since variables use up the same amount of space, no matter what the value, squeezing the two numbers into one cuts in half the memory used for the two variables.

Using this system, the number 330021 would mean 21 laps on 3/30. 1201101 would mean 101 laps on the first of December.

The two formulas needed in the program are simple. To combine the two numbers into a single variable DL, DL=D*1000+L, or date times 1000 plus laps. To uncrunch the numbers, D=INT(DL/1000) and L=DL-1000*D. Date is the integer value of DL divided by 1000. Laps is DL minus 1000 times the date.

Depending on the range of values, you could combine three, four, or more variables into one. But you should be aware of one limitation—once a number goes beyond nine digits, it is rounded off. Try to avoid using numbers larger than 99,999,999. Also, fractions are not always as reliable as integers, because they get rounded to the nearest base-two fraction.

Multiple Binary Values

A variation on this technique can be used when the values are all yes/no decisions. In the example above, the dates ranged from 101 to 1231, the number of laps from 0–999. Altogether, seven decimal digits were used in the final doubled up variable.

Instead of multiplying by ten, one hundred, one thousand, and so on, you can multiply by twos (1, 2, 4, 8, 16, etc.). What you are doing, in effect, is turning individual bits on and off. (Note that this technique would not work on the swimming program, because date and laps are not yes/no situations.)

For example, you want a program to keep track of a few hundred members who belong to the local user group. In addition to the usual information about name/address/phone, you have the following categories:

1	Adult Member/Student
2	VIC Owner
4	64 Owner
8	Interest in BASIC
16	Interest in ML
32	Interest in Games
64	Interest in Education
128	Interest in Business
256	Willing to Help Organize
512	Willing to Teach Seminar

When a new person signs up for the user group, he or she provides the above information (all yes or no questions). The appropriate numbers are added up; for example an adult with a 64, interested in BASIC, games, and educational software would be given the number 109.

The different categories can be sorted out with a logical AND. In the program, each member has been assigned a number, let's say variable J. IF (J AND 16) = 16 then the person is interested in machine language. If it equals zero, then the member is not interested. Loop through the membership list, reading J and ANDing it with 16, and you'll find out who has that particular interest.

You can also combine categories. Maybe you want to set up a seminar on programming ML games on the 64, but don't know who would be interested. The categories are 4, 16, and 32, so you could have the computer search through the list of members. A single line would find all people who checked the three boxes when they joined, IF (J AND 52)=52 THEN C=C+1. The variable C, in this case, is used as a counter, to keep track of how many members are interested in ML games for the 64. If you checked the 512 bit, you might then find someone who is willing to teach the seminar.

In the example above, instead of ten different variables using up (at least) five bytes each, you reduce everything to a single variable per member, with bits acting as flags which are up or down. Thus, you use a tenth as much memory, and this gives you more room for adding new members or categories.

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User Group Update

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Send additions, corrections, and deletions for this list to:

COMPUTE! Publications
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Attn: Commodore User Groups

Changes

The new contact address for the Sacramento Commodore Computer Club is P.O. Box 227, Sacramento, CA 95810.

The Commodore Brooksville User Group (C-BUG) has a new contact person, Eleanor Hott, who can be reached care of C-BUG, P.O. Box 1261, Brooksville, FL 33512. The phone number is (904) 799-5292.

The Memphis Commodore Users Club also has a new address: P.O. Box 38095, Bartlett, TN 38134-0095.

The North Country (NY) Computer Club has changed its name to North Country Commodore Club. The new contact person is Eleanor Cunningham, who can be reached at 1607 Ford Street, Ogdensburg, NY 13669. The phone number is (315) 393-2708.

Another group with a new name is the Nova Scotia Commodore Computer Users Association, formerly the Nova Scotia Commodore Computer User Group. The new address is P.O. Box 3426, Halifax South, Halifax, Nova Scotia B3J 3J1.

New Listings

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Arkansas 64 Trading Post
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Tri-County Commodore Users Group
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Lansing Area Commodore Club
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East Lansing, MI 48823-1065
(517) 351-7061

Video Innovation Club (V.I.C.)
Michael Levay
424 Woodlawn
Roscommon, MI 48653

MISSOURI

Northeast Missouri Commodore Users Group (NEMOCUG)
Terry Kinney
555 Western Drive
Macon, MO 63552
(816) 385-2955

or contact:
Stephen Foltz
P.O. Box 563
Macon, MO 63552
(816) 385-5530

NORTH CAROLINA

Commodore Users Group of Fayetteville (CUGOF)
Steve Peterson
P.O. Box 41601
Fayetteville, NC 28309
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Westcom 64 Commodore Users Group of Western Cincinnati
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Spartanburg Commodore Users Group (SPARCUG)
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VIC-20 & Commodore 64 User's Group
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GAMES (C-64 User Group)
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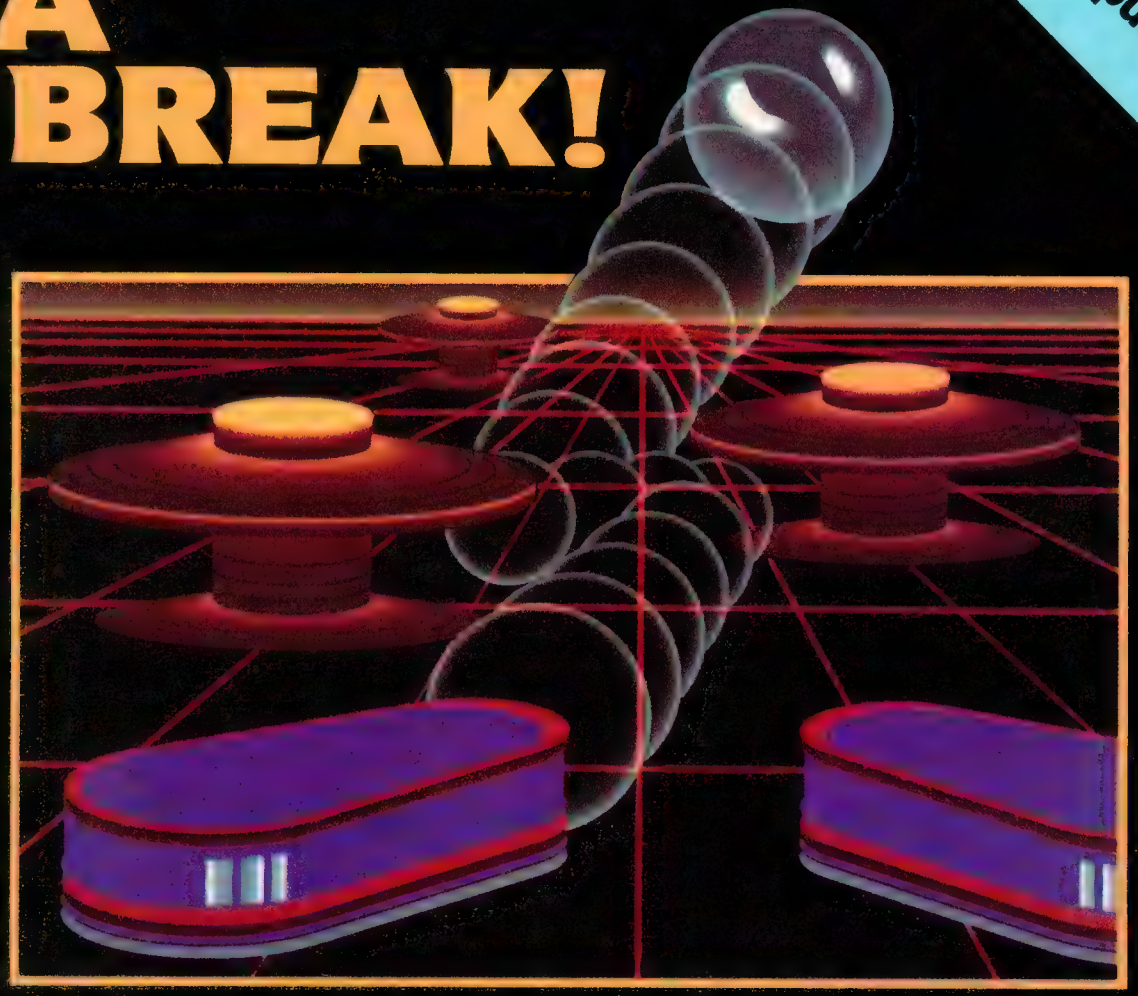

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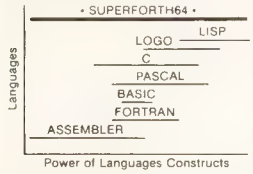

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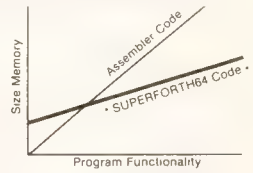

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A user group is being formed in Randallstown, Maryland. Those interested should contact Steven Ziglar, C-64 & VIC-20 Users Group of Randallstown, 8827 Sigrid Road, Randallstown, MD 21133. The phone number is (301) 655-8402.

The Pomona Valley Commodore Users' Group has changed its name to Cal Poly Commodore Users' Group. The contact person is David Dietzel, and the address is 14617 1/2 Ramona Boulevard, Baldwin Park, CA 91706. The phone number is (818) 960-9906.

COM-VICS, a Commodore and VIC-20 user group in Maine, has a new mailing address. Inquiries should be sent to COM-VICS, Commodore/VIC Users Group, P.O. Box 1541, Auburn, ME 04210.

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Seven Cities of Gold

Gregg Keizer, Assistant Editor, Books

Your expedition has landed on uncharted territory as the search for gold and glory continues in Seven Cities of Gold.

Games are fantasies. Even the simplest children's game, like hide-and-seek or tag, has elements of fantasy. Hide and I'm invisible; your touch is poison. Most computer games are fantasies in one way or another, too. You become a fighter pilot in *Zaxxon*, or a frantic tunneler in *DigDug*. Some games make fantasies seem more realistic (sounds almost like a contradiction) than others. Often these realistic games, whether they're electronic or played on a board, are called simulations.

But what does all this have to do with *Seven Cities of Gold*?

Two things really. First, *Seven Cities* is a simulation. Second, it's a fantasy.

I'm not saying that the game is unreal, or even untrue to history. Quite the opposite. It's one of the most interesting games I've played, one that kept me staring at the screen and holding the joystick long after I would have walked away from most games. But it *is* a fantasy, at least for me. It probably will be for you, too.

Orellana And The Amazon

A long time ago, I read an account of Francisco de Orellana. He's rarely mentioned in the histories of the Spanish conquest of South America. A relative of the Pizarro family (Francisco Pizarro was already governor of Peru, having defeated the Incan Empire in 1533), he accompanied an expedition across the Andes in 1541. The 200 Spaniards and their 4000 slaves were searching for cinnamon trees and gold. After crossing the mountains, the Conquistadors dropped into the edges of a vast jungle. They found their cinnamon trees, which were too far from civilization to be worth anything. The expedition then turned to the east, to the 2-1/2 million square miles of the Amazon Basin. Eventually they reached the Napo River, one of the tributaries of the Amazon.

Natives told the Spanish of a great city of gold downstream. It was a good way to get the invaders out of the area. So Orellana and 50 men began their fantastic voyage. For 17 months, on crude rafts or simple ships they built themselves, the Spaniards saw mile after mile of river. What they were doing was crossing the continent by navigating the entire Amazon River! Of course, there were close calls with natives (including, according to Orellana, a tribe led by women—the famous "Amazons"), times when they almost starved, and weeks of depression and disease.

But they reached the Atlantic on August 26, 1542. They even made it back to Spanish settlements by sailing along the coast. Orellana was greeted as a hero by the King when he returned to Spain.

I've always imagined being a part of this strange and wonderful odyssey. Until now, however, there was no way to play out that fantasy—I really didn't want to go down the Amazon, I just wanted to *imagine* doing it.

1492

Seven Cities of Gold let me do just that. Designed and created for Electronic Arts by Ozark Softscape, the team which brought us *M.U.L.E.*, this computer game/simulation makes you one of the first Spanish explorers of the New World.

Starting in 1492 with a small fleet of ships, complete with armed men, food, and trading goods, you sail west across the Atlantic. You hope there's something on the other side, something you can set foot on and claim before your food runs out and your men begin starving. You find it. Now the decisions begin to pile up.

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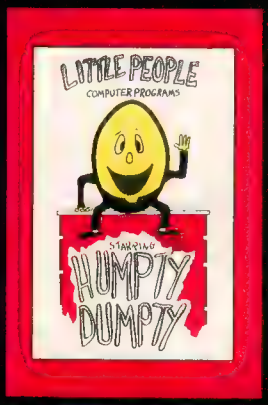

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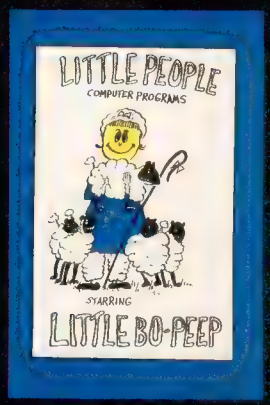

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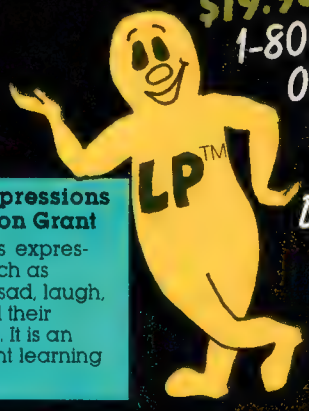

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do when a native village is finally found? Enter and trade, or enter and kill?

Simple To Play

Seven Cities is quite simple in its play mechanics. Once you've followed the directions and created a map disk (you need a blank disk to play the game, as well as a joystick), loaded the game and watched the title display, the only thing you have to do is move the joystick and press the fire button. Menus appear when needed. Before you leave Spain, for instance, you can walk into the outfitter to buy supplies. A menu is displayed which lets you purchase additional ships, men, food, and goods, *if* you have the gold. There are other menus available while your expedition is exploring. They're all accessed by pressing the joystick fire button. Expedition movement, whether on land or sea, and combat are controlled with the joystick.

Once you make landfall, you need to create another expedition. You can select its composition, choosing the number of men and the amount of trading goods and food. Jungles, swamps, mountains, plains, and rivers are there for the exploring.

And there are hundreds of villages, towns, and cities scattered across the two continents (*Seven Cities* includes both North and South America). If you earlier chose the novice level of play, the settlements can be seen. When you move up to the higher levels, however, the natives can only be found if you stop and search. Settlements will blink if they're nearby, giving you an idea of where to head.

Peace Or War?

As soon as you move into a village, town, or city, you have an ethical decision to make. Trade for the gold and food you need, or simply take it. It's a fascinating decision. To be historically accurate, *Seven Cities* has to allow the player to repeat history. The Conquistadors, for all their bravery and exploits, were little more than thugs in their relations to the natives. They rarely traded, instead opting for the quick and simple approach—intimidate the natives until they handed over whatever wealth they had.

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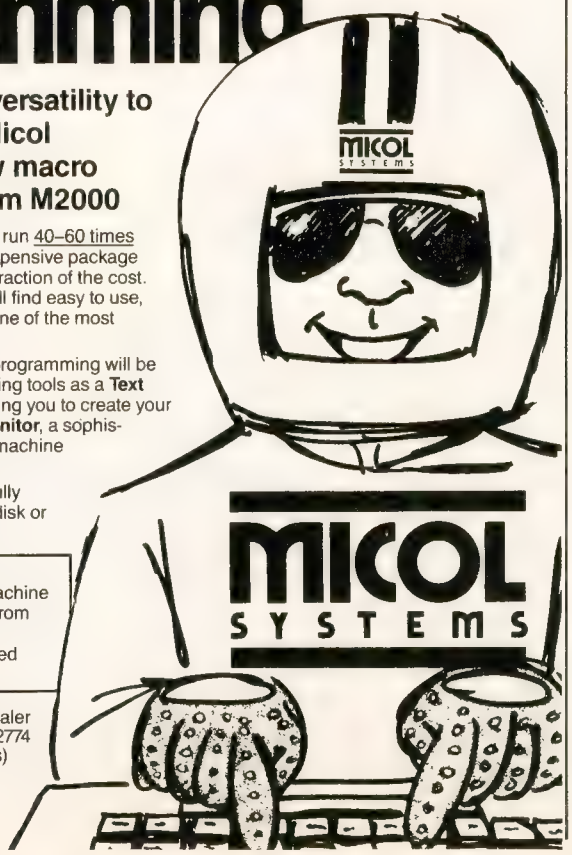

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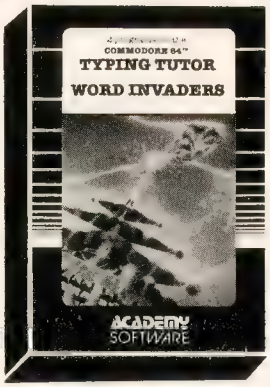

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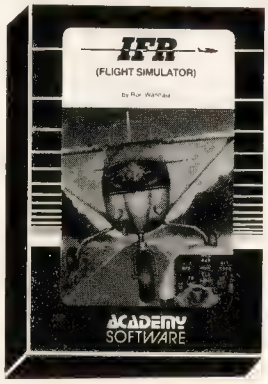

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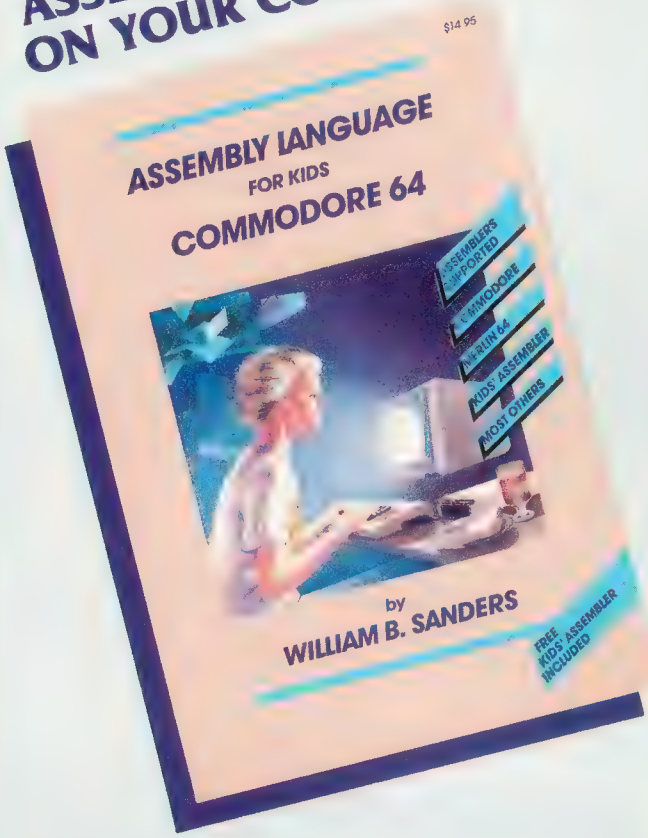

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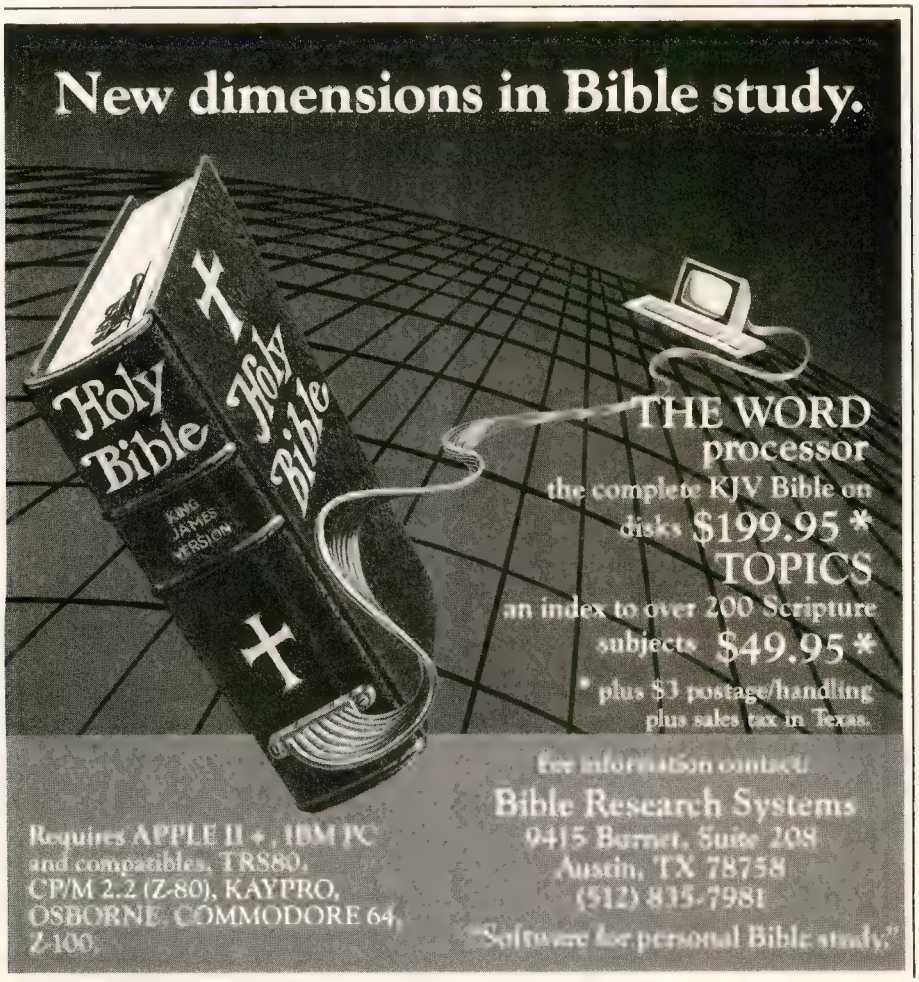
the natives and accidentally kill them. Do that often enough and you enrage them. You'll have a fight on your hands in a moment, and the result is the same as it would have been had you charged into the place with murder in your heart.

The designers of *Seven Cities* have made warfare somewhat abstract. It's just not *fun* to wipe out entire villages and towns, certainly not as thrilling as destroying fleets of alien spaceships that dodge and twist. All you do is move your figure beside a native and the native vanishes.

Making war does have a price. Word spreads from village to town to city of your cruelty, and you'll be ambushed often. You also won't get any help from the natives, something crucial to success. Without willing natives to help carry things, your expedition can't travel far, or walk away with large amounts of food or gold. In the higher levels of play, your bearers can even help you find settlements you overlooked.

Heading Home

There'll come a time when you have to sail for home. Usually it's because your expedition is low on food or out of trading goods. If you've been fighting natives, it may be because there are few soldiers left. Navigating home is done the same way as sailing to the New World. Use the view map feature to find your latitude. Home is at 30° North. Once home, you can report to the king, perhaps receive a promotion and additional moneys; go to the pub to save the game map to disk; or go to your own home to view your progress. The outfitter waits for you, too. Using the gold you obtained on the voyage, you can buy more ships, equip more men, and load more food and goods. You're ready to sail on another voyage.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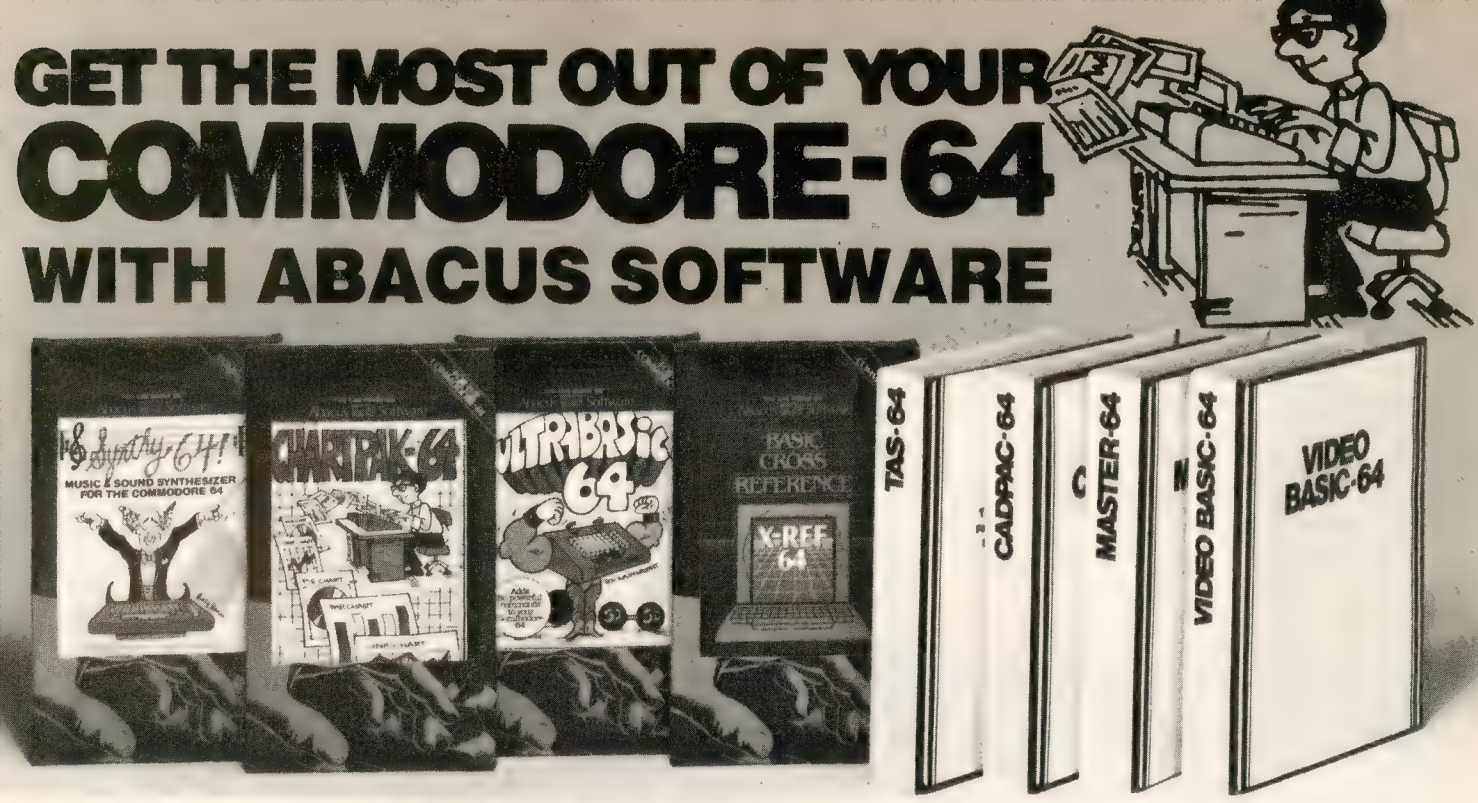

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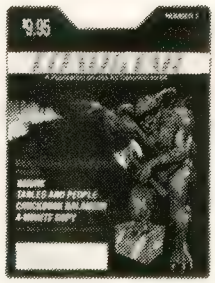

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Step Through The Menu

The program is designed for ease of use. Included in the package is a reference card which has step-by-step instructions on how to load the program. If you're using the program for the first time, you should select 1, "How to Use *Childpace*" from the main menu. This program illustrates the computer and shows how to use the function keys. On every screen, the operation of the function keys (f7 to move forward, f5 to move backward, and f3 to return to the main menu) are shown, and any other significant keys are highlighted. The use of color for emphasis is effective, and text is clear on either a color or green-screen monitor.

Selection 2 on the main menu is "Background," which presents the philosophy of *Childpace*. If you're one of those people who doesn't read the printed material that comes in the package, you can get the information from this program. Although a 27-page manual comes with the software, all the same information is included in the programs.

Selection 3 is a "Practice Run-Through," which is essentially instructions on how to administer the tests. Example questions for you to score are shown. "Rose," an attractive character who can jump, hop, and walk, is introduced to help you understand by way of illustration some of the motor skills. If you don't understand how to do a particular skill that is described in words, press E (for Example), and Rose will appear on the screen and demonstrate.

Testing A Child

After you've seen the first three selections, you're ready to start testing a child. Selection 4 is Parent Questions and must be completed for each child you test. Enter the child's name and sex, plus the date of testing and the child's birth date. The computer calculates the number of months for the age. Depending on the child's age, you will be asked some questions about the child, most of which are in the Personal and Social Skills area. Again, the program is easy to use. Press Y for yes and N for no, or the space bar to erase. You may use f5 to back up, or f3 to go back to the main menu. The computer accepts only certain key presses and ignores all others. The colors indicate where you need to answer.

After answering the Parent Questions, you can select 5 to

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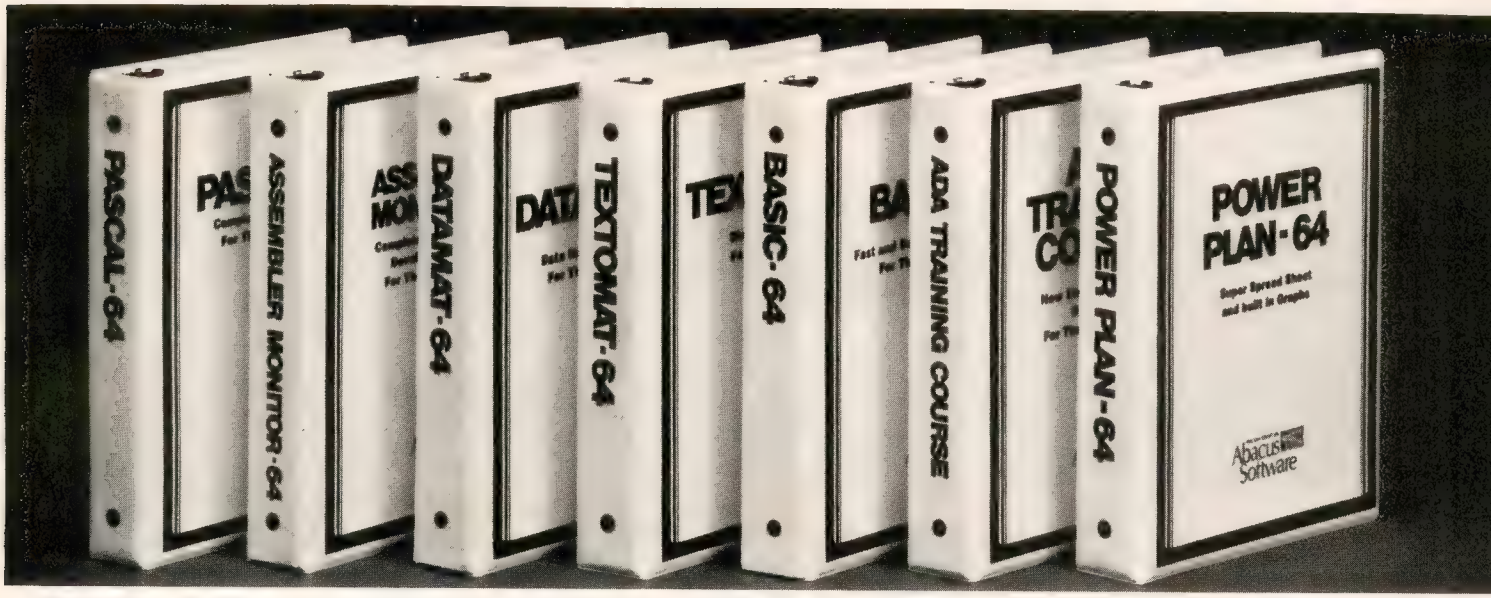

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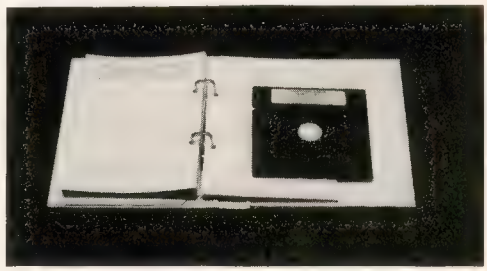

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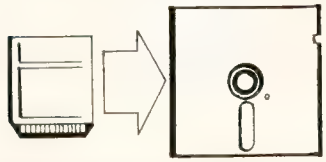

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Begin or Resume Exercises. After three screens of instructions, you start testing with the child present. The instructions for each skill are explicit, and for the most valid results you should do and say exactly what the computer directs. On some of the skills, you may demonstrate, but on others the score depends on how much instruction you must give.

Some of the motor skills include standing in place and jumping, a distance jump (jumping over a sheet of paper), hopping, catching a ball, and walking backward heel to toe. Remember, if you aren't sure what the activity is, you can press E to see Rose perform the activity.

A *Childpace* Record Booklet is included to aid in testing the detailed movement. One of the activities, for example, is to copy a circle (although you are not allowed to say the word "circle" to the child). Another is to draw a cross. (My son said, "OK, I'll draw a plus.") One skill is to draw a person, and the score is determined by how much detail the child provides. The manual shows examples of passing and failing results or how to score the drawing of a person.

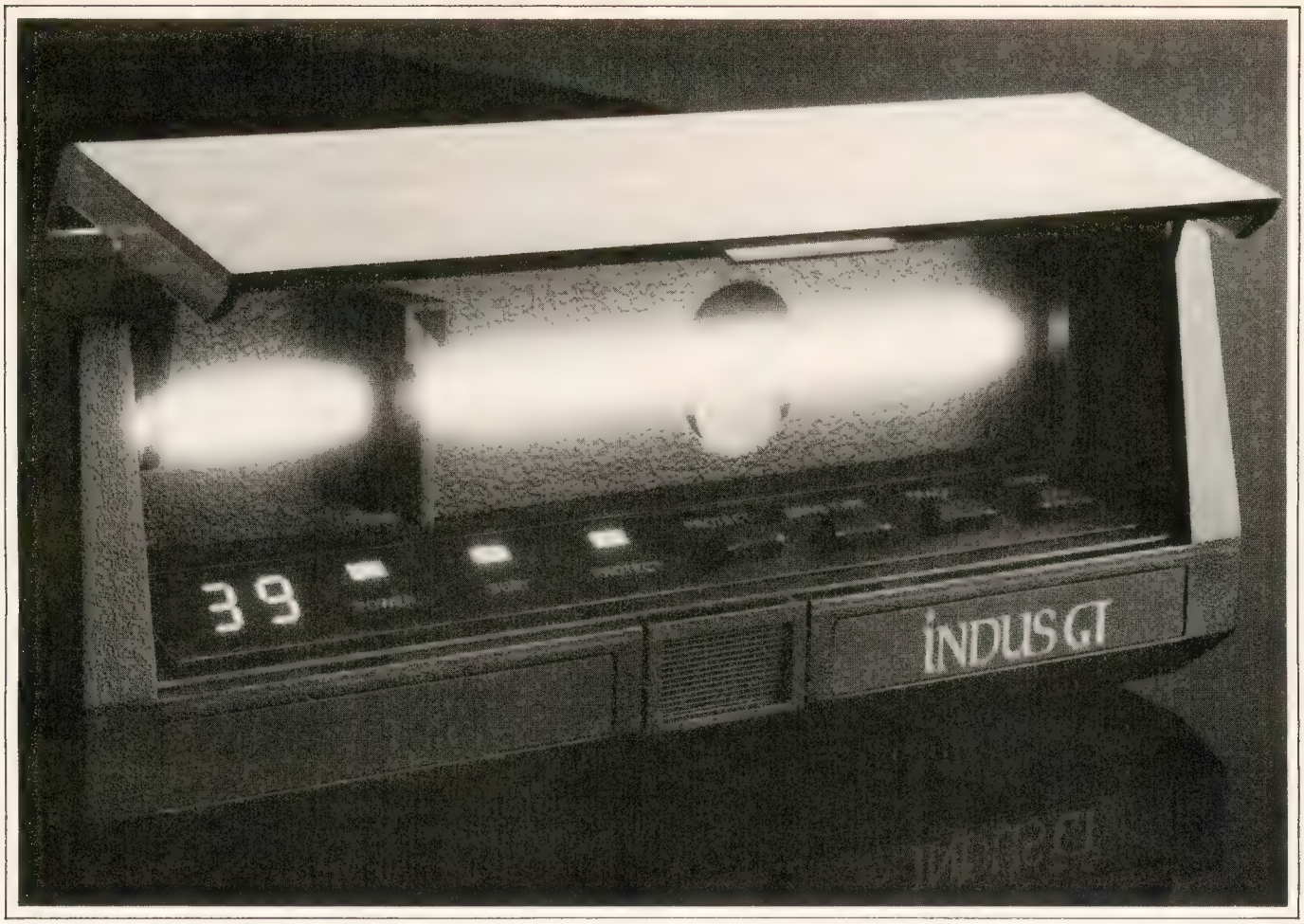
For younger children, Language Skills test items may have questions about pronouncing words or understanding parts of the body. Older children need to recognize colors (colored blocks are included in this package), repeat sequences of words, recognize opposites, define words, and tell object composition: For example, what is a spoon made of? What is a shoe made of? What is a door made of? In defining the words, you have to consider that this program only chose a few words, and that doesn't necessarily make a comprehensive test. For example, my son didn't know what the word "pavement" meant. At first he thought I said "payment." When I showed him the pavement, he said it was concrete or asphalt or was more specific with sidewalk, driveway, and street.

The Personal and Social Skills are mostly answered in the Parent Question section. These skills include dressing, feeding, washing hands, and social interaction with others.

Evaluating The Results

The next section is viewing the results. First, an explanation of the results is discussed, then you get a report for each of the four areas. Each screen tells how the child performed in up-to-age items, challenge items, and above-age items. Pressing CTRL-P gives you a printout (actually a screen dump) of the report. If you press f7 to continue, you see an attractive graph of the results with arrows showing the child's skill level compared with "norms." After the last graph, an evaluation of the child is given with a general summary.

If the report indicates the child is behind schedule, the manual says "don't push the panic button," and lists several reasons for possible negative results, along with some suggestions. The manual also gives a



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list of professional resources, people who can help provide assistance with the child if needed.

When I had my first child, I got several books that had lists of what the child should do at certain ages. As interested and concerned parents, we checked those lists periodically to see how our daughter was doing. With our fifth child, we were much more relaxed and assumed he would walk eventually, talk when he got around to it, and play with other children when he got to school. We haven't paid much attention to standards and norms. However, it was a lot of fun to try out this program to see how our four-year-old compared with the average.

My assessment? It would be fun to start with a young baby, then keep track of the progress every few months. An electronic baby book! The best thing about this program is its ease of use, designed so that any parent (even one who has never used a computer) can use it. The instructions are clear and understandable. Blocks, a tube, and a pom-pom come with the package.

The manual is easy to understand and has helpful examples. The program itself is "user-proofed" so you can't crash it with bad key presses. The screens show exactly what keys may be pressed for answers, scoring, or to go to different screens. *Childpace* lends itself to use either at home or in nursery schools to help with assessing child development.

Childpace
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Also Worth Noting

Rockney Disk Utilities

Rockney Disk Utilities (RDU) is an all machine language, menu-driven collection of disk utilities. With a colorful text display, RDU makes it easy to access almost every disk feature, eliminating the need for OPEN 15,8,15. Features supported are: enhanced directory, display sector, display BAM (Block Allocation Map), trace file (shows all sectors used by a file), initialize, display error channel, copy disk, edit sector, rename, copy file, concatenate (merge) files, validate, and scratch. Programmers will especially appreciate the ability to display and edit sectors. Pressing a function key can give you a help screen, hex to decimal and decimal to hex conversion, and a screen dump. Two extra programs permit you to perform single drive file copying and full disk backup. Unlike some disk utility packages, *Rockney Disk Utilities* has no provision for backing up copy-protected disks.

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The manual tersely covers all the disk commands and includes technical information on how each command works. This approach may be confusing to beginners, but it's more than substantial for intermediate programmers. Indeed, the value of this package is educational. The manual includes techniques for unscratching a file, modifying a machine language program without loading it into memory, and packing disk files, explaining not only how it's done, but why it works.

Rockney Software
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The Voice Messenger

This new product from Currah Technology adds speech synthesis to a Commodore 64. It doesn't require an external speaker—the voice goes through the television or monitor speaker. Installation is easy: Simply plug it into the cartridge port, then take the cable leading out of the cartridge and plug it into the audio/video socket. Since the same socket is used by the monitor cable, a Y-connector is available from Currah for use with a monitor.

The Voice Messenger adds five new commands to BASIC, which can be used within a program or in direct mode. The manual also includes the necessary technical information for machine language programmers. INIT (initialize) turns on the voice. BYE turns it off. KON turns on the key-speech feature, which says each key when it is pressed. For example, if you enter the BASIC line 10 PRINTA, you hear *one-oh-space-pea-ar-eye-en-tee-ay-return.* All graphics characters are pronounced *graphic.* Key-speech could be a great help for people entering data, children learning the alphabet, or teaching touch typing to the blind. KOFF turns off this feature.

The fifth command, SAY, speaks letters, words, or sentences. It must be followed by a string or string variable. Unlike some voice modules, the vocabulary is not limited to a certain number of words. The different sounds of English are built-in. *The Voice Messenger* uses a system of rules for deciding how a word should be pronounced (for example, *plough* is pronounced differently than *cough*, even though they're spelled similarly).

Using allophones gives you even more control over the sounds. The hard *g* sounds in *big* and *got* are actually (slightly) different. So you could type SAY "HELLO" or, using allophones to make it sound more like English, SAY "[HE(LL)(OO)]". The full list of allophones is included in the manual.

The sounds to be spoken are stored in a buffer which holds up to 255 allophones (about 25 to 30 seconds of speech). Because it is interrupt-driven, BASIC programs do not slow down or stop while words are being spoken. There are two voices, a low one that sounds a bit like Darth Vader and a higher one. Two intonations are available for each voice, normal and emphasized.

Currah also markets speech synthesizers (in England) for the VIC-20 and the Sinclair Spectrum. *The Voice Messenger,* now available in America for the 64, is an easy-to-use, entertaining speech processor. And the price is right.

Currah Technology
50 Milk Street/15th Floor
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Tapper

One of the most addictive games we've seen lately, this Bally Midway arcade translation for the 64 from Sega has a lot going for it. *Tapper* is not only fun to play, but also immensely challenging, graphically entertaining, and full of action.

It might first appear to be just another super-fast arcade game, but the longer you play, the more you realize it's a very well-designed strategy game. As the "tapper" (bartender), you are serving a rude and motley crew of publicans whose thirst is nearly impossible to quench. There are four bars, and you must move quickly from one to the other to service the nearest customer. As the mob approaches, waving their fists, you must decide in what order they should be served. If one reaches the bar without being served, be prepared to be picked up by the collar and thrown down the bar. Inglorious treatment for all your efforts.

If that isn't enough, you must also retrieve the empty

mugs as they return sliding back down the bar toward you. Unfortunately, many of the patrons want immediate refills. A key to staying alive for any length of time in the game is to pick up the occasional tip (if you have time). This triggers a chorus line of dancing girls which distracts some of the patrons and lets you catch your breath.

Dexterity with a joystick is a must for this game. Controlling the tapper isn't so difficult, but moving fast enough and to the right place at the right time is taxing to the point of exhaustion.

The title screen offers several options: one or two players, and Beginner, Arcade, or Expert levels. The Beginner level is a real handful. The first scenario is a Western bar (1890s). Make it past this one to go to a county fair, where the action picks up. If you make it through this scenario, you're treated to an abominable punk-rock bar. And, finally, an outer space bar with creatures a la *Star Wars*. Between scenarios, you can rest or play a guessing game with the Soda Bandit (sponsored by *Mountain Dew*).

You stay in the game simply by not losing one of your lives (five at the Beginner level, three at the others). A life is erased if you're thrown down the bar, fail to catch a returning mug, or slide a refill down the bar to a customer who's just left. You can gain extra lives by achieving a high number of points (depending on the level you choose).

Tapper is not for the timid, but we rate it near the top in entertainment value.

Sega Enterprises, Inc.
Sega Consumer Products
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disk or cartridge
(price unavailable)

Mancopter

Pedaling a copter across the skies? Be serious. Too childlike. Though that may be your reaction to reading the directions to this game, or even seeing it on the screen, it's only a first impression. *Mancopter* is a game for the 64 that's challenging enough for adults and picturesque enough for children.

As a pilot in the great mancopter race, you need to evade dozens of computer-controlled mancopters, dodge fish-stealing pelicans, and avoid falling dodo birds and leaping squids on your way to the finish line. It's never easy, for as soon as you stop hitting the joystick button, you begin to lose altitude. There are other obstacles, too, like tangled mangrove trees that force you to skim the water, or waving mermaids who want your last fish.

The scrolling screen moves smoothly as you fly from right to left. You can reverse direction, but its impossible to fly far that way. Not that you want to; there's a time limit. You need to reach that next buoy to get another 40 seconds on the clock.

If you bop other copters from above, they drop into the water. Unfortunately, they can do the same to you. Then you have to give one of your valuable fish to the whale. Otherwise, he won't come and provide his back as a launching pad. You begin the race with four fish. But it seems everything is trying to take them from you. Pelicans, squid, dodo birds, and even mermaids want them. There *are* ways to get more—some of the pelicans and mermaids have a fish in their beaks or hands, and if you're agile, you can take them.

Scoring is based on capturing fish, bopping and passing other mancopters, and finishing the race. Bonus points for passing mancopters are awarded when you land at a raft checkpoint.

The game gets more frenetic as you must fly under more and more of the mangrove trees. Avoiding the fish-stealers becomes increasingly difficult. Storm clouds appear and lightning bolts search you out. But the pace is worth it. The game is challenging and graphically entertaining.

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Richard Mansfield, Senior Editor

ML Mailbag

If you have a question about machine language (ML), please send it to the address at the end of the column. This month let's answer some commonly asked questions:

Using The Kernal

How do you clear the screen in ML? I've tried filling it with 32's, the space character, but I know there's a better way. Also, how do you check what's being typed into the computer from the keyboard? I've tried looking at location 197, but it doesn't work out.

To effectively program in ML, you need several tools: an assembler, a disassembler, a map of your computer's memory (especially the BASIC and Kernal ROM routines), and a table of the Commodore version of the ASCII code (often called a Character Set Table). You'll find the first three in my book, *Machine Language for Beginners* (available from COMPUTE! Books or in most bookstores), and we've reprinted the Commodore ASCII table this month.

Your questions suggest that you are unfamiliar with the Kernal section of the BASIC ROM. Many of the fundamental things you ordinarily do in BASIC are easily accessed from ML programs as well. In BASIC you would just PRINT a clear screen character. You can clear the screen in ML by:

```
LDA #147
JSR 65490
```

The 147 is Commodore ASCII for clear-the-screen (see the table below) and you just load 147 into the Accumulator and then JSR to the computer's built-in PRINT routine. At the very top of ROM memory are several important addresses (referred to collectively as the *Kernal*) which can be used in your ML programming. The Kernal addresses are the same on a VIC and 64.

To simulate a BASIC INPUT command, JSR 65487. To simulate GET, JSR 65508. Probably the most useful of all the Kernal routines is 65490. The Commodore ASCII character value currently in the Accumulator will be printed to the screen. What's especially useful about this routine is that it remembers where the cursor would be. In other words, the next time you print what's in the Accumulator, the new character will be placed immediately following the previous character. You can also use all the special codes for clear screen, delete, backspace, etc. Other useful Kernal routines open and close files, save and load programs, read the time, check the STOP key, and read or set the position of the cursor on the screen.

STANDARD ASCII

1	start of heading
2	start of text
3	end of text
4	end of transmission
5	enquiry
6	acknowledge
7	bell
8	backspace
9	horizontal tabulation
10	line feed
11	vertical tabulation
12	form feed
13	carriage return
14	shift out
15	shift in
16	data link escape
17	device control 1 (X-on)
18	device control 2
19	device control 3 (X-off)
20	device control 4
21	negative acknowledge
22	synchronous idle
23	end of transmission block
24	cancel
25	end of medium
26	substitute
27	escape
28	file separator
29	group separator
30	record separator
31	unit separator

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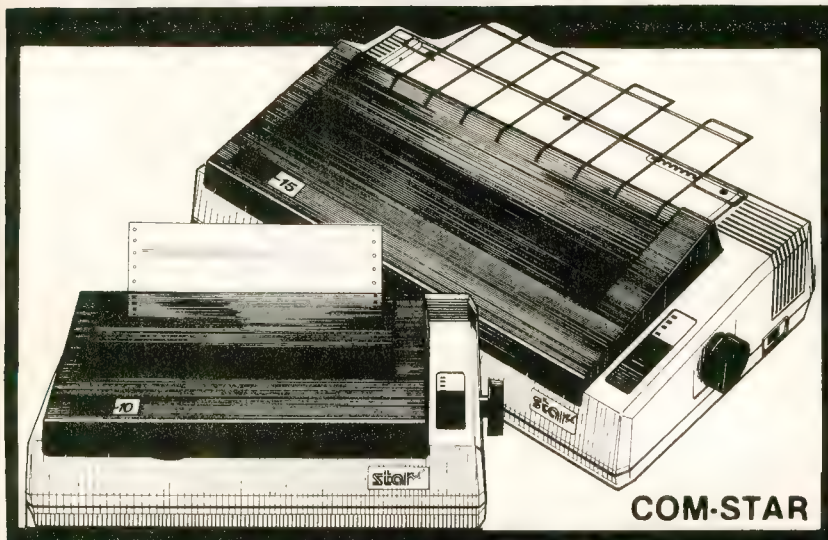

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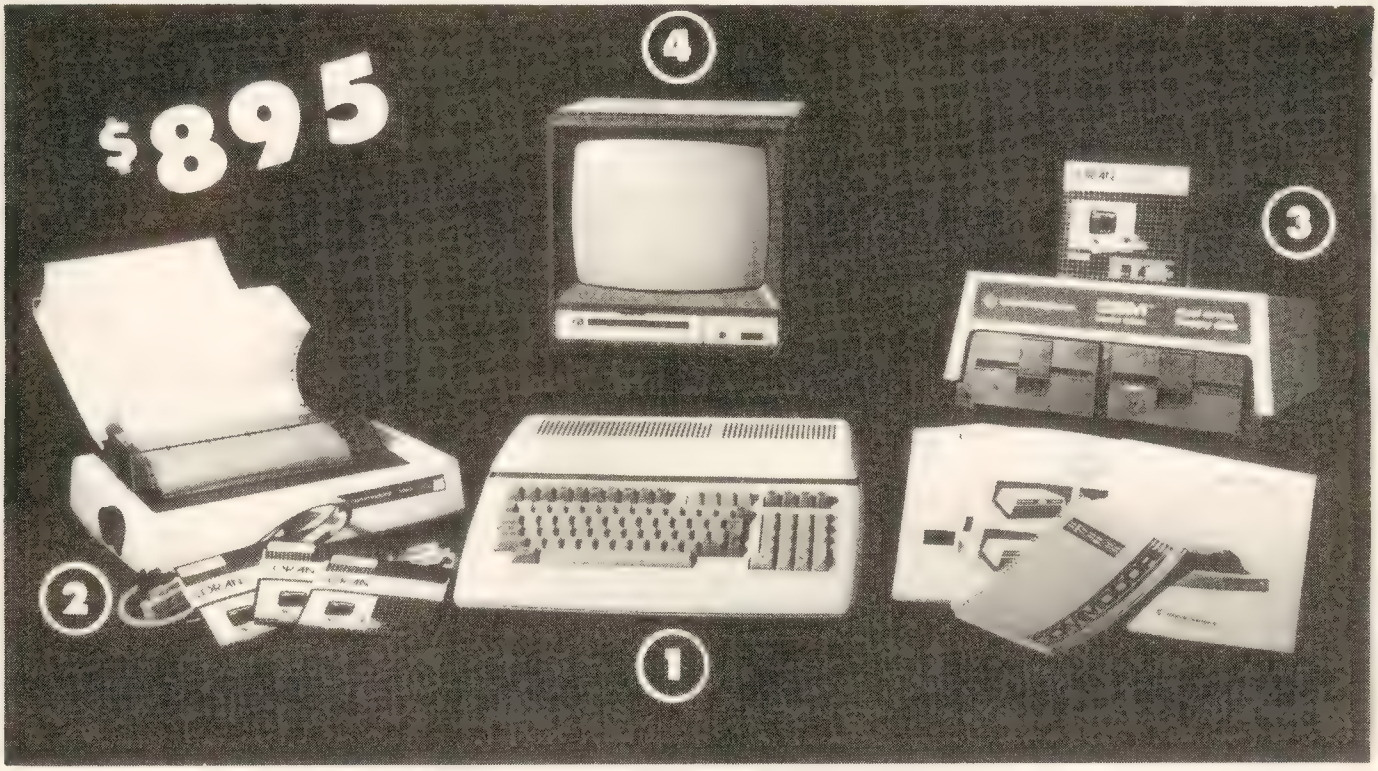

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DEC	HEX	BASIC	6502	ASCII	SCREEN DISPLAY SET 1	SET 2
0	0	END LINE	BRK		@	
1	1		ORA ($ZZ,X)		A	a
2	2				B	b
3	3				C	c
4	4				D	d
5	5		ORA $ZZ	white	E	e
6	6		ASL $ZZ		F	f
7	7				G	g
8	8		PHP	disables shft/Cmdr	H	h
9	9		ORA #$II	enables shft/Cmdr	I	.
10	A		ASL		J	,
11	B				K	k
12	C				L	l
13	D		ORA $NNNN	return	M	m
14	E		ASL $NNNN	lowercase	N	n
15	F				O	o
16	10		BPL $NN		P	p
17	11		ORA ($ZZ),Y	crsr down	Q	q
18	12			reverse on	R	r
19	13			clr/home	S	s
20	14			inst/del	T	t
21	15		ORA $ZZ,X		U	u
22	16		ASL $ZZ,X		V	v
23	17				W	w
24	18		CLC		X	x
25	19		ORA $NNNN,Y		Y	y
26	1A				Z	z
27	1B				[	
28	1C			red	£	
29	1D		ORA $NNNN,X	crsr right	]	
30	1E		ASL $NNNN,X	green	↑	
31	1F			blue	←	
32	20	SPACE	JSR $NNNN	space	space	
33	21	!	AND ($ZZ,X)	!	!	
34	22	"		"	"	
35	23	#		#	#	
36	24	$	BIT $ZZ	$	$	
37	25	%	AND $ZZ	%	%	
38	26	&	ROL $ZZ	&	&	
39	27	`		`	`	
40	28	(	PLP	(	(	
41	29	)	AND #$II	)	)	
42	2A	*	ROL	*	*	
43	2B	+		+	+	
44	2C	,	BIT $NNNN	,	,	
45	2D	-	AND $NNNN	-	-	
46	2E	.	ROL $NNNN	.	.	
47	2F	/		/	/	
48	30	0	BMI $NN	0	0	
49	31	1	AND ($ZZ),Y	1	1	
50	32	2		2	2	
51	33	3		3	3	
52	34	4		4	4	
53	35	5	AND $ZZ,X	5	5	
54	36	6	ROL $ZZ,X	6	6	
55	37	7		7	7	
56	38	8	SEC	8	8	
57	39	9	AND $NNNN,Y	9	9	
58	3A	:				
59	3B	;		;	;	
60	3C	<		<	<	
61	3D	=	AND $NNNN,X	=	=	
62	3E	>	ROL $NNNN,X	>	>	
63	3F	?		?	?	

DEC	HEX	BASIC	6502	ASCII	SCREEN DISPLAY SET 1	SET 2
64	40	@	RTI	@		
65	41	A	EOR ($ZZ,X)	A	♠	A
66	42	B		B		B
67	43	C		C		C
68	44	D		D		D
69	45	E	EOR $ZZ	E		E
70	46	F	LSR $ZZ	F		F
71	47	G		G		G
72	48	H	PHA	H		H
73	49	I	EOR #$II	I		I
74	4A	J	LSR	J		J
75	4B	K		K		K
76	4C	L	JMP $NNNN	L		L
77	4D	M	EOR $NNNN	M		M
78	4E	N	LSR $NNNN	N		N
79	4F	O		O		O
80	50	P	BVC $NN	P		P
81	51	Q	EOR ($ZZ),Y	Q	●	Q
82	52	R		R		R
83	53	S		S	♥	S
84	54	T		T		T
85	55	U	EOR $ZZ,X	U		U
86	56	V	LSR $ZZ,X	V		V
87	57	W		W		W
88	58	X	CLI	X	♣	X
89	59	Y	EOR $NNNN,Y	Y		Y
90	5A	Z		Z	♦	Z
91	5B	[		[		
92	5C	£		£		
93	5D	]	EOR $NNNN,X	]		
94	5E	↑	LSR $NNNN,X	↑	π	
95	5F	←		←		
96	60		RTS		space	
97	61		ADC ($ZZ,X)	♠		
98	62					
99	63					
100	64					
101	65		ADC $ZZ			
102	66		ROR $ZZ			
103	67					
104	68		PLA			
105	69		ADC #$II			
106	6A		ROR			
107	6B					
108	6C		JMP ($NNNN)			
109	6D		ADC $NNNN			
110	6E		ROR $NNNN			
111	6F					
112	70		BVS $NN			
113	71		ADC ($ZZ),Y	●		
114	72					
115	73			♥		
116	74					
117	75		ADC $ZZ,X			
118	76		ROR $ZZ,X			
119	77					
120	78		SEI	♣		
121	79		ADC $NNNN,Y			
122	7A			♦		
123	7B					
124	7C					
125	7D		ADC $NNNN,X			
126	7E		ROR $NNNN,X	π		
127	7F					

ADDITIONAL NOTES: **SCREEN CODES:** CODES 128-255 are reversed images of CODES 0-127.

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*The answer is San Marino.

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DEC	HEX	BASIC	6502	ASCII
128	80	END		
129	81	FOR	STA ($ZZ,X)	orange
130	82	NEXT		
131	83	DATA		
132	84	INPUT#	STY $ZZ	
133	85	INPUT	STA $ZZ	F1
134	86	DIM	STX $ZZ	F3
135	87	READ		F5
136	88	LET	DEY	F7
137	89	GOTO		F2
138	8A	RUN	TXA	F4
139	8B	IF		F6
140	8C	RESTORE	STY $NNNN	F8
141	8D	GOSUB	STA $NNNN	shift/carriage return
142	8E	RETURN	STX $NNNN	uppercase
143	8F	REM		
144	90	STOP	BCC $NN	black
145	91	ON	STA ($ZZ),Y	crsr up
146	92	WAIT		reverse off
147	93	LOAD		clr/home
148	94	SAVE	STY $ZZ,X	inst/del
149	95	VERIFY	STA $ZZ,X	brown
150	96	DEF	STX $ZZ,Y	lt. red
151	97	POKE		gray 1
152	98	PRINT#	TYA	gray 2
153	99	PRINT	STA $NNNN,Y	lt. green
154	9A	CONT	TXS	lt. blue
155	9B	LIST		gray 3
156	9C	CLR		purple
157	9D	CMD	STA $NNNN,X	crsr left
158	9E	SYS		yellow
159	9F	OPEN		cyan
160	A0	CLOSE	LDY #$II	space
161	A1	GET	LDA ($ZZ,X)	
162	A2	NEW	LDX #$II	
163	A3	TAB(		
164	A4	TO	LDY $ZZ	
165	A5	FN	LDA $ZZ	
166	A6	SPC(	LDX $ZZ	
167	A7	THEN		
168	A8	NOT	TAY	
169	A9	STEP	LDA #$II	
170	AA	+	TAX	
171	AB	-		
172	AC	*	LDY $NNNN	
173	AD	/	LDA $NNNN	
174	AE	↑	LDX $NNNN	
175	AF	AND		
176	B0	OR	BCS $NN	
177	B1	>	LDA ($ZZ),Y	
178	B2	=		
179	B3	<		
180	B4	SGN	LDY $ZZ,X	
181	B5	INT	LDA $ZZ,X	
182	B6	ABS	LDX $ZZ,Y	
183	B7	USR		
184	B8	FRE	CLV	
185	B9	POS	LDA $NNNN,Y	
186	BA	SQR	TSX	
187	BB	RND		
188	BC	LOG	LDY $NNNN,X	
189	BD	EXP	LDA $NNNN,X	
190	BE	COS	LDX $NNNN,Y	
191	BF	SIN		
192	C0	TAN	CPY #$II	
193	C1	ATN	CMP (ZZ,X)	
194	C2	PEEK		
195	C3	LEN		
196	C4	STR$	CPY $ZZ	
197	C5	VAL	CMP $ZZ	
198	C6	ASC	DEC $ZZ	
199	C7	CHR$		
200	C8	LEFT$	INY	
201	C9	RIGHT$	CMP #$II	
202	CA	MID$	DEX	
203	CB	GO		
204	CC		CPY $NNNN	
205	CD		CMP $NNNN	
206	CE		DEC $NNNN	
207	CF			
208	D0		BNE $NN	
209	D1		CMP ($ZZ),Y	
210	D2			
211	D3			
212	D4			
213	D5		CMP $ZZ,X	
214	D6		DEC $ZZ,X	
215	D7			
216	D8		CLD	
217	D9		CMP $NNNN,Y	
218	DA			
219	DB			
220	DC			
221	DD		CMP $NNNN,X	
222	DE		DEC $NNNN,X	
223	DF			
224	E0		CPX #$II	
225	E1		SBC ($ZZ,X)	
226	E2			
227	E3			
228	E4		CPX $ZZ	
229	E5		SBC $ZZ	
230	E6		INC $ZZ	
231	E7			
232	E8		INX	
233	E9		SBC #$II	
234	EA		NOP	
235	EB			
236	EC		CPX $NNNN	
237	ED		SBC $NNNN	
238	EE		INC $NNNN	
239	EF			
240	F0		BEQ $NN	
241	F1		SBC ($ZZ),Y	
242	F2			
243	F3			
244	F4			
245	F5		SBC $ZZ,X	
246	F6		INC $ZZ,X	
247	F7			
248	F8		SED	
249	F9		SBC $NNNN,Y	
250	FA			
251	FB			
252	FC			
253	FD		SBC $NNNN,X	
254	FE		INC $NNNN,X	
255	FF	π		

ASCII CODES: CODES 192-223 same as 96-127 CODES 224-254 same as 160-190 CODES 255 same as 126

Which One Is The Real Machine Language?

I have seen many useful programs in your magazine which show how to program in machine language using three-letter commands. I have also seen a number of programs which are nothing but a stream of numbers (that have to be entered using the MLX program in the back of the magazine).

Which of these is true machine language? Is there any way I could go from one form to the other?

Those three-letter ML commands are the equivalent of BASIC commands. In both ML and BASIC there are around 50 commands, but people commonly only use about 20 of them. Machine language commands are abbreviations: LDA stands for LoaD the Accumulator, JSR for Jump to SubRoutine.

You write ML programs using an *assembler* into which you type LDA and the assembler translates that LDA into a number. The computer cannot understand LDA; it needs the number. That's because the computer's language (machine language) is pure numbers, no letters of the alphabet. But numbers are harder for us to remember than words like JSR. So, the assembler translates these commands into the numeric form that the computer can run.

To answer your first question, *both* the commands and the numbers are true machine language: They're just different forms of the same program. When an ML program is in the form of commands, it's called *source code*. After an assembler translates these commands into numbers, the result is called *object code*. So, you go from the version people can use most easily to the computer-runnable version by assembling source code into object code.

To go the other way, you use a program called a *disassembler* which looks at the pure numbers of the object code and reconstructs them into a listing of the original, three-letter commands.

As you can see, the same ML program can be printed in COMPUTE!'s GAZETTE in three forms: as source code, as object code (for MLX), or as object code which is listed in DATA statements within a little BASIC program (called a BASIC loader) which POKEs the object code into memory for you. To see examples of all three forms, take a look at last month's column. The program therein is printed as source code (Program 1), as a disassembly (Program 2), and as object code in a BASIC loader (Program 3). These are three different versions of the same program.

Where Can I Find An Advanced Assembler?

Where can I get an assembler that allows variables; automatic insert (so I can move the whole program forward in memory as many bytes as I want); and line numbering (like in BASIC)?

The LADS assembler in my new book, *The Second Book of Machine Language* (COMPUTE! Books), includes all those features.

IF, THEN, And GOTO In Machine Language

I have noticed that there are two different ways of using the CoMPare commands (CMP) in ML. I'm not sure which method works or how. They are: 1. Using BEQ or BNE after CMP to check for equal or not equal and 2. Using BCC or BCS after a CMP to check for the same thing. Would you please explain this?

The BEQ/BNE (branch if equal/branch if not equal) and BCC/BCS (branch if less than/branch if more than or equal) pairs are not checking for the same thing as we'll see in a minute.

CMP is one of the most important ML instructions. It's always used in tandem with one of the instructions beginning with the letter *B* which branch to a different part of your program depending on the results of the comparison. In other words, CMP followed by, for example, BEQ, is the equivalent of this line in a BASIC program:

```
10 IF A = 20 THEN GOTO 1000
20 RETURN
```

however you write the ML like this:

```
CMP #20
BEQ 1000
RTS
```

Whenever you use CMP, you are always CoMParing against whatever is currently in the Accumulator. So, in the example above, you will branch to *address* 1000 if the number in the Accumulator is a 20; otherwise, as in BASIC, you will go on to the next command (RTS, in this example).

By the way, be sure to remember that all the *B* instructions are limited to branches 127 bytes in either direction *from their own address*. If, in our example above, your BEQ command were assembled into memory at address 1020, that would be within range. If it were assembled to address 1500, you couldn't make a branch 500 bytes long, all the way down to 1000. You have to give a branch target which is within plus or minus 127 bytes. Many assemblers will

automatically take care of this problem for you, but if you're using a simple assembler, you'll need to watch that you don't branch out of range.

In any case, each of the important *B* instructions you mention is equivalent to one of the BASIC comparison operators: =, <>, <, or >=. BEQ is the same as =; BNE (<>); BCC (<); and BCS (>=). Since they are so important, you might want to spend a few minutes practicing with them until you understand exactly what triggers each of these various branches. Set up a little program like this (the numbers on the left are the addresses where these instructions are assembled):

```
830   LDA   #20
832   CMP   #20
834   BEQ   840
836   BCC   846
838   BCS   852
840   LDA   #61
842   JSR   65490
845   RTS
846   LDA   #60
848   JSR   65490
851   RTS
852   LDA   #62
854   JSR   65490
857   RTS
```

After you've assembled this, you can SYS 830 and you should see an equals sign (=) printed on screen, proving that you made the BEQ branch. The 20 in the Accumulator was equal to the 20 being compared. Now POKE 831,15, replacing the 20 in the Accumulator with a number which is *less than* the CMP #20. When you next SYS 830, you will see that a branch based on less-than took place. The less-than symbol is printed. Finally, try POKEing in a number higher than 20.

If you have questions which you would like to see answered in this column, please write to:

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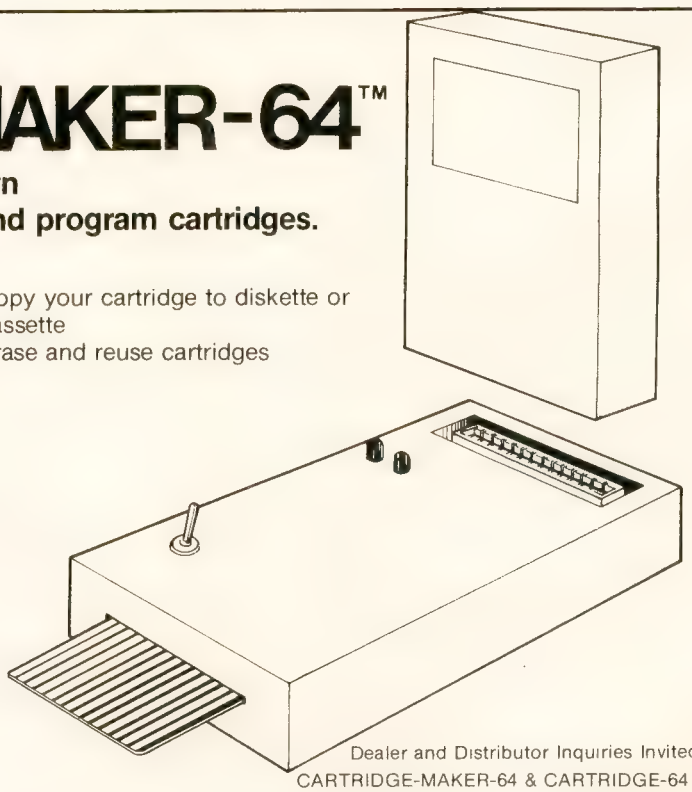

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Debugging BASIC
Part 1

Todd Heimarck, Assistant Editor

Program bugs have a thousand faces. No matter how experienced a programmer might be, there's almost always a time between finishing and really completing a program—debugging time. This month we'll see what the computer does when you make a mistake. Next month, in Part 2, we'll look at some useful debugging methods as well as some of the mistakes a computer can make.

Some program bugs are easy to recognize: The program crashes and you are told what kind of error you made. Or, worse, the computer locks up. These are the deadly, or *fatal* bugs.

Other bugs are sneakier and not as easy to recognize. Perhaps you've made a slight mistake and the program seems to run, but is actually making incorrect calculations (like figuring interest rates on a 13-month year). Subtle bugs are sometimes worse than fatal ones; at least you can recognize something's wrong when the program crashes.

A bug happens when the programmer says one thing and the computer either doesn't know how to do it, or does something very different.

Some people say that computers never make mistakes, that all bugs are caused by people. That's not always true. After all, computers are designed and manufactured by people who can make mistakes. It may be a hardware bug or one built into the operating system. Or maybe the programmer just didn't understand how the computer would interpret a line—a misunderstanding rather than a mistake. But a computer is pigheaded. It knows how programs should look and won't compromise. Next month we'll look at some of the mistakes computers can make.

For now, we'll concentrate on some of the mistakes we, as programmers, can make and how the computer deals with them.

SYNTAX ERROR

There are over two dozen error messages, but SYNTAX ERROR seems to appear most often. The line number is always included.

The first thing to do, of course, is to LIST the offending line. Take a good look at it. If there are parentheses, make sure they match up. There should be an equal number of opening and closing parentheses.

Also, check all the BASIC keywords to make sure they're spelled correctly. You may have mistakenly abbreviated LEN as L SHIFT-E (which turns out to be the abbreviation for LET, not LEN). If you are writing to disk or tape files, you should note that the command PRINT# is distinct from the ordinary PRINT. The abbreviation for PRINT# is P SHIFT-R (not ?#); using a question mark won't work when working with tape or disk files.

Look at the punctuation, a common source of errors. It's easy to accidentally type a period instead of a comma, a semicolon where you meant to put a colon. Or there may be mismatched opening and closing quotation marks in a PRINT statement. If you're copying a program from a book or magazine, look closely at the look-alike characters (I and 1, O and 0).

Tokens, Keywords, And Reserved Variables

When you type a program line and press RETURN, you must have at least one BASIC *keyword* (command or function) in the line for it to be legal. Even the do-nothing REM is a BASIC keyword. The computer reads the line from the screen and turns all keywords into tokens before the line is stored in memory. A token is a single number between 128 and 255 which represents the command or function.

You must avoid including keywords in variable names. Say you're writing a simple accounting program which figures out the profit margin you make on different items. You need a variable for the price you pay (call it COST), another variable for the amount for which you sell it (call it LIST, for list price), and one more for the profit (MONEY). Then you calculate the margin with the formula MONEY = LIST − COST. Right? Wrong.

All three variables are illegal and will crash the program. LIST is a keyword used to list a

program; you can't use it as a variable. COST doesn't look like a keyword, but the first three letters spell COS; your computer will try to find a cosine of an angle, although it will stop when it can't find parentheses and an argument. And MONEY is a problem because the keyword ON (as in ON-GOTO or ON-GOSUB) is embedded in the variable name. When you find an embedded keyword in one part of a program, there's a good chance the same variable is used elsewhere, in other sections. You'll have to find all of them and change them to something legal.

In addition to the many keywords, there are three reserved variables which you can't use in your programs. They are TI, TI$, and ST. The first two are used for timekeeping, and ST is short for STatus, which is used in input/ouput operations. Stay away from these variable names, unless you know you want to check the time or status. You can't define TI or ST, although you can print them to the screen and use them in IF-THEN statements and logical operations. You *can* define TI$, which is useful for timing programs, but it has to be a six-digit string (for example, TI$= "103000" sets the clock to 10:30 a.m.).

A VIC or 64 is a little more forgiving with the reserved variable names than with keywords. You can't use a variable TIPS because TI is included in the first two letters of the name. But you *can* use a variable name like ITIN, which has a TI in the middle, because only the first two letters of a variable name count. ITON, on the other hand, is not acceptable as a variable name, because there are two BASIC words in it (TO and ON), and BASIC words cannot appear *anywhere* in a variable name.

Program Glue

Need a program line inserted between 10 and 20? No problem. Type a line 15 and press RETURN; the computer automatically inserts the line in its proper position. LIST 10–20 will prove that the line is there where you wanted it.

It's almost as if your VIC or 64 broke the program in two and pasted the line in its proper place.

This cut-and-paste feature, usually quite handy, can become a curse which results in two kinds of program bugs.

The first bug, truncated lines, is relatively easy to find. It usually occurs when keywords are abbreviated. If, for example, you use ? instead of PRINT, or P SHIFT-O instead of POKE, you can create logical lines which are legal when they're entered, but exceed the limit when listed. Later editing of the line leads to problems.

If you use abbreviations and multistatement lines, the result is sometimes a line which looks longer than should be possible when listed. A question mark takes up only one space on a line; but LIST detokenizes and changes that single letter into five: PRINT. List such a line on a 64 and you may see two full screen lines plus a few characters on the third line. And the program runs without errors. But go back to edit the extra-long line, press RETURN, and the input buffer will read only the first two screen lines into memory. The result is truncated—or chopped off—program lines. You lose the last few characters. To get around the two-line limit (four on a VIC), you have two choices. Either retype the keywords using abbreviations or break the long line into two shorter lines.

This limit on line length means it's a good idea to press RETURN only when you're editing a line. To move around the screen, use the cursor keys (or SHIFT-RETURN, which does not enter the line in program memory and is also a way to get out of quote-mode).

The second bug, which is more difficult to find, happens when your computer seems to glue two program lines together. Say you're writing a program on a VIC-20. Line 500 uses exactly 44 characters (two screen lines). You type the line, but forget to press RETURN. The cursor is positioned at the beginning of a screen line, so you type line 510 and press RETURN. The computer treats the two lines as one because it received only one RETURN. The same thing can happen on a 64 if the first line is exactly 40 characters.

Some Other Common Errors

POKEs and SYSes can wreak havoc if improperly used. Most lockups are caused by one or the other of these powerful commands. When you're debugging, watch for transposed or missing digits in POKEs and SYSes (POKE 53820 instead of POKE 53280, for example).

Duplicate variable names can cause all sorts of problems. You might use a variable called A to hold a value at the beginning of the program, and then inadvertently use the same variable name later on. If the program returns to the beginning, the value has changed. FOR-NEXT loops sometimes lead to duplication. When you're using a variable like A, make sure you don't use it as an index in a FOR-NEXT loop. And remember only the first two characters of a variable count; the computer thinks ALT is the same variable name as ALIEN.

To avoid doubled variables, it helps to pick certain letters to be used only in loops and as "temporary" variables. For example, decide ahead of time you will always use J, K, and L in FOR-NEXT loops.

Be careful with additional statements after an IF-THEN. If the condition (between IF and THEN) is *not* true, the program jumps to the next

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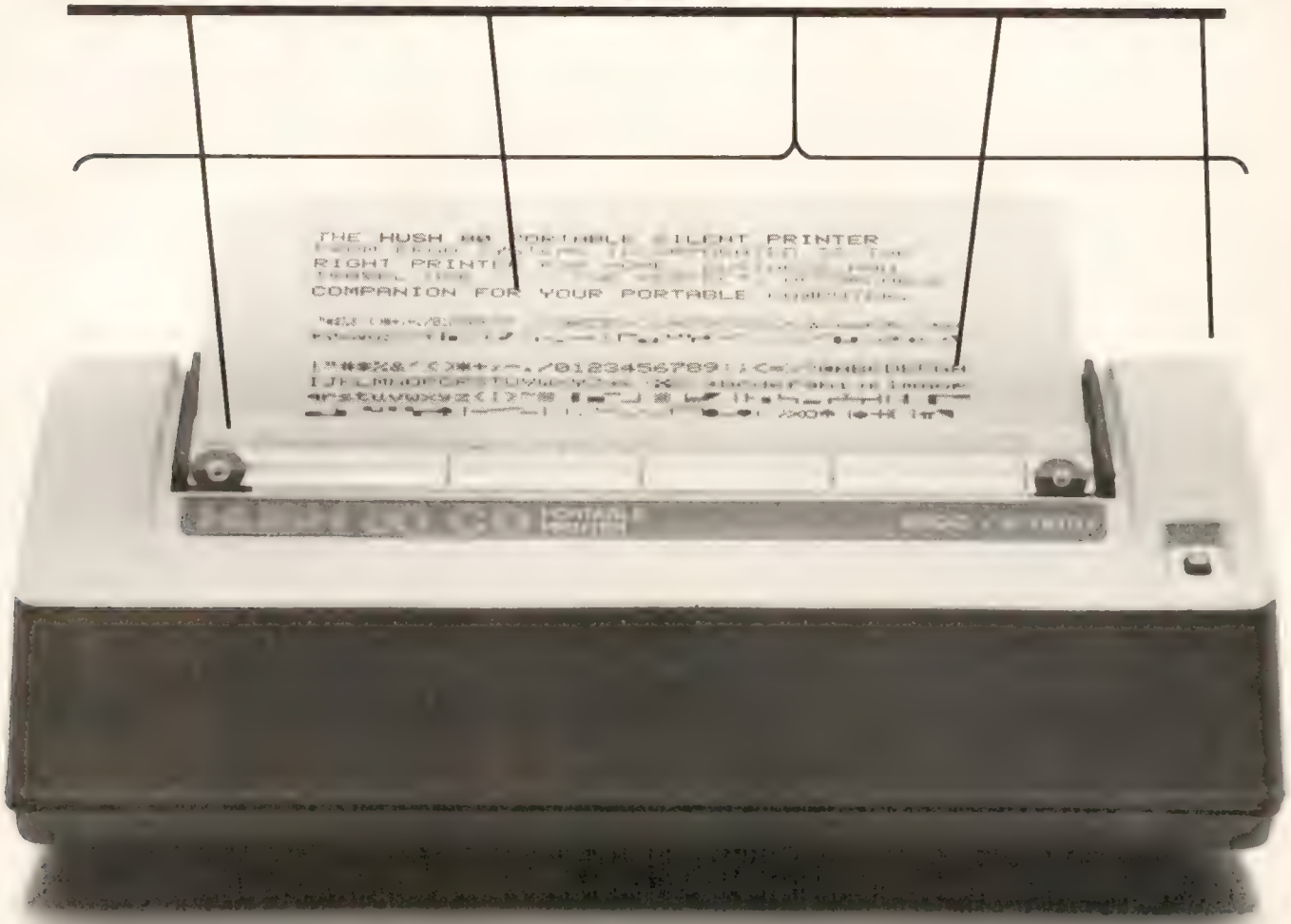

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BASIC line; it doesn't fall through to the next colon. For example, in this line:

```
55 IF A=1 THEN B=15: PRINT "NEXT
QUESTION?" :INPUT Q
```

the PRINT and INPUT statements will happen only if A equals one. If not, everything after the THEN is ignored. This feature is useful if you want multiple actions under certain conditions. But it can catch you if you don't know about it.

The error message RETURN WITHOUT GOSUB is usually the consequence of the common practice of putting subroutines at the end of a program. The computer finishes the main routine and continues through to the first subroutine until it reaches the RETURN statement. The quick fix is to place an END statement between the main routine and the first subroutine. For example, if subroutines begin at line 5000, add a line 4999 END.

NEXT WITHOUT FOR, an infrequent error message, generally comes from improper nesting of loops. Loops are like onions; you can build layers which completely enclose other layers. In other words, the first loop to begin has to be the last to end.

```
1 FOR J=1TO5: FOR K= 3TO15: NEXT K: NEXT J
2 FOR J=1TO5: FOR K= 3TO15: NEXT J: NEXT K
```

Line 1 is correct because the K-loop is inside the J-loop. But line 2 spells trouble because loops cannot overlap.

The use of arrays can lead to easily rectified errors. It's best if you DIMension all arrays at the beginning of a program, or in a one-shot subroutine. Once you use DIM, you can't use it again on the same array name or you'll get a REDIM'D ARRAY error.

Order Of Operation

Most of the mistakes described above will cause your program to stop with an error message on the screen of your TV or monitor. They're situations where you tell the computer to do something and it doesn't recognize what you want. Program crashing errors are inconvenient, of course. But it's nice to have the computer tell you what kind of mistake you made and which line was wrong.

Less convenient are errors of procedure, where you write a program to do one thing, but it ends up doing something completely different. It doesn't crash, but it does strange things to the screen, or gives seemingly impossible results.

You have probably used instructions which you interpret one way, but the computer interprets another. And you can't change the way your computer does things, unless you want to completely rewrite the operating system (even changing the rules of BASIC means you have to follow the rules of machine language). Some programmers wish they could have a new BASIC command DWIM (Do What I Mean), which would instantly straighten out procedural errors.

One of the most common problems with mathematical calculations comes from the way the computer evaluates equations. There is a definite order of operations, sometimes called the hierarchy of operators, (the items at the top of the list have a higher priority):

( )	**Parentheses**
↑	**Exponentiation (up arrow)**
+ −	**Plus and Minus Signs**
* /	**Multiply and Divide**
+ −	**Add and Subtract**
=	**Equals (Assignment)**
= < >	**Comparisons: Equals, Less Than, Greater Than**
NOT	**Logical NOT**
AND	**Logical AND**
OR	**Logical OR**

Note that some operations, like NOT, work on a single number; they're called unary. Most need two numbers and are called binary functions. Plus and minus signs can be either unary (in the number −3, the minus sign works on a single number) or binary (the minus sign connects two numbers in the expression 10 − 6).

Because the higher operations are calculated first, you can always figure out the results of an equation. For example, J = 4 + 5 * 3 assigns 19 to J because the multiplication is done first, binary addition second, and assignment-equals third.

When you're debugging a program and one of the variables is being consistently miscalculated, there's a good chance you're a victim of the hierarchy. The quickest way to fix such an error is to liberally sprinkle parentheses throughout the suspicious equations. Your other choice is to trace through the line step by step, to find how the computer is evaluating the equation.

There's a slight chance that using too many parentheses in debugging can lead to one of the more puzzling errors, stack problems, caused by one of the various limits you have to live with.

Memory Limits: The Stack

There are two causes of OUT OF MEMORY errors. The first is programs and variables filling up all available BASIC RAM (more likely to happen with a VIC). The second is a stack overflow (the likely cause of OUT OF MEMORY errors on a 64).

Let's look at the stack first. The *stack* is a special section of memory just above zero page. It takes up most of page 1. The stack is used by the operating system for notes to itself.

When a 64 or VIC begins a FOR-NEXT loop, it writes a note about where in memory the loop

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begins, pushes it on the stack, and forgets about it until it comes across a NEXT statement. NEXT tells the computer that somewhere earlier in the program a FOR started a loop. It then pulls the information it needs off the stack and jumps back.

Something similar happens when there are parentheses in an equation, and when you use GOSUB. To illustrate, type NEW and try running the following program:

```
10 A=A+1: PRINTA
20 GOSUB 10
```

A very short program with only one variable counts up to 24 and then crashes. How could it possibly run out of memory? The key is the GOSUB. Every time you go to a subroutine, the return address is saved on the stack. Since there are no RETURNs in the program, more and more addresses are saved, until finally there is no stack space left. It's as if you were trying to stick more and more notes to a refrigerator, until the magnet could hold no more.

Type NEW and enter this program:

```
10 FORA=1TO20
20 FORB=1TO20
30 FORC=1TO20
(and so on, up to 130 FORM=1TO20)
```

Don't worry about adding any NEXTs, the computer will never get that far. Run the program and you'll get an OUT OF MEMORY error after only ten loops have begun. A FOR-NEXT loop uses up a lot of space on the stack—for a pointer to beginning of the loop, step size, highest value, and variable names.

When stack problems pop up, they're often caused by a GOTO in the middle of a subroutine. It can leave some garbage on the stack. The same goes for jumping out of a FOR-NEXT loop. And too many parentheses can give you either a FORMULA TOO COMPLEX error or contribute to an OUT OF MEMORY message. As the garbage on the stack builds up, it eventually reaches the limit.

Programs And Variables

The other way to run out of memory is fairly straightforward. You simply use too much BASIC RAM for the program and its variables. Try the following program:

```
10 T$="ABCD":U$=""
20 L=FRE(0):IFL<0THENL=L+2↑16
30 L=INT((L-30)/3):DIM A$(L)
40 FORJ=1TOL
50 A$(J)=T$+U$
60 PRINT J; LEN(A$(J)), FRE(0)
70 NEXTJ
```

It runs on a VIC (expanded or not) or a 64. You'll run out of memory almost right away.

Now change line 50:

```
50 A$(J)=T$
```

Run it again and there's no loss of memory. It will run all the way through (press RUN/STOP if you don't want to watch hundreds of strings go by). The first program wasn't able to create even ten four-letter strings, the second created hundreds. The only difference is that the first program added a null string (which has a length of zero); the second did not. The first created *dynamic strings*, the second created *static strings*.

If you define a string by concatenating (adding two strings together), by dissection (dividing a string with MID$, LEFT$, or RIGHT$), or by inputting it (from a tape or disk file, or the keyboard) the string is called dynamic. It has to use up part of BASIC memory. If you define it in BASIC, assigning it (A$="ABC") or reading it from DATA statements (READA$), the computer saves memory by remembering where the definition was in program memory. Your VIC or 64 doesn't have to use free memory to store static strings. They're already in BASIC memory.

If you define a lot of variables (as in the above program), available memory can dwindle to nothing. When you find your program running out of memory, you can try a number of things:

1). **Check free memory.** If there seems to be a lot left, you may have a full stack, caused by too many unresolved FOR-NEXT loops or GOSUBs.

2). **Eliminate unnecessary program lines, especially REMarks.** Or combine two or more statements on a single line separated by colons (every line uses five bytes for overhead, whether it has one statement or eight).

3). **Cut back on variables.** If you're using arrays, remember that integer arrays use less than half the space of floating point arrays.

4). **Completely rewrite your program.** It sounds drastic, but once you've figured out the procedures you're using, the second version of a program is often faster and uses less memory.

5). **Try chaining programs.** If you have a lot of instructions in a game program, you can write a loader program which prints the instructions and then loads the main program.

Next month, we'll look at some quirks of the VIC and 64, how imprecise and inaccurate math can be, why you can sometimes PRINT impossible-to-INPUT variables to a tape or disk file, why programs sometimes pause as if locked up and then continue, and more. We'll also look at a variety of methods to hunt down and eliminate bugs.

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Stop And Go

Jim Pejsa

When a program is running and the telephone rings, what do you do? This short machine language routine provides a pause button which temporarily halts the program. It also works on program listings. For VIC and 64.

A very useful function found on many other computers is missing from Commodore computers. Many computers allow the programmer to stop and restart a program listing or run using CTRL-S and CTRL-Q.

Pressing the CTRL key on the VIC or 64 will slow the listing down, but to carefully study a program it's often necessary to stop the listing. Having to continue the listing by retyping LIST followed by some line numbers (if the program is long) is an inconvenience. Additionally, there are times when you want to stop a program (maybe to study some output) and restart it at will.

Since I was anxious to try some machine language programming, I decided to write a program to add this feature. CTRL-S (for stop) and CTRL-Q (for restart) seem to be standard for these functions on many computers. The program is designed in such a way that the realtime clock will continue to be updated while processing is stopped.

The machine language for the program in the DATA statements is loaded by the BASIC program. Simply type in the program and run it to load the ML. The program loads beginning at location 679 ($02A7) in some unused locations below the BASIC program area, so it will not interfere with any BASIC programs. The SYS statement in line 30 starts the machine language program. Unfortunately, if RUN/STOP–RESTORE is ever used to stop a program, you will find that the CTRL-S and CTRL-Q functions become inoperative. You can get them back by typing SYS 679.

Briefly, the program works as follows. When it is initially started with SYS 679 in BASIC, the hardware interrupt (IRQ) vector is changed to point to this program. The program is accessed each time the hardware interrupt occurs (every 1/60 second). The program checks for a CTRL-S keypress. If it's detected, it stops the listing or run and then checks for CTRL-Q. When CTRL-Q is pressed, the listing or run is restarted.

Program 1: Stop And Go—64 Version

```
10 FORI=679TO743:READ A:X=X+A:POKEI,A:NEX
   T                                :rem 119
20 IFX<>7291THENPRINT"ERROR IN DATA STATE
   MENTS.":STOP                     :rem 135
30 SYS679                             :rem 8
40 DATA 120,169,180,141,20,3,169    :rem 29
50 DATA 2,141,21,3,88,96,173        :rem 95
60 DATA 141,2,201,4,208,42,165     :rem 179
70 DATA 197,201,13,208,36,120,169  :rem 87
80 DATA 49,141,20,3,169,234,141    :rem 241
90 DATA 21,3,88,173,141,2,201      :rem 135
100 DATA 4,208,249,165,197,201,62  :rem 88
110 DATA 208,250,120,169,180,141,20
                                   :rem 169
120 DATA 3,169,2,141,21,3,76        :rem 83
130 DATA 49,234                    :rem 224
```

Program 2: Stop And Go—VIC Version

```
10 FORI=679TO743:READ A:POKEI,A:X=X+A:NEX
   T                                :rem 119
20 IFX<>7589THENPRINT"ERROR IN DATA STATE
   MENTS.":STOP                     :rem 145
30 SYS679                             :rem 8
40 DATA 120,169,180,141,20,3,169    :rem 29
50 DATA 2,141,21,3,88,96,173        :rem 95
60 DATA 141,2,201,4,208,42,165     :rem 179
70 DATA 197,201,41,208,36,120,169  :rem 88
80 DATA 191,141,20,3,169,234,141    :rem 31
90 DATA 21,3,88,173,141,2,201      :rem 135
100 DATA 4,208,249,165,197,201,48  :rem 92
110 DATA 208,250,120,169,180,141,20
                                   :rem 169
120 DATA 3,169,2,141,21,3,76        :rem 83
130 DATA 191,234                   :rem 14
```

Part 1

Baker's Dozen

Lawrence Cotton

A short, carefully designed program can produce some amazing results. To demonstrate, here's the first of a three-part series of 13 graphics and sound programs which entertain and amuse. A number of effective programming techniques are demonstrated also.

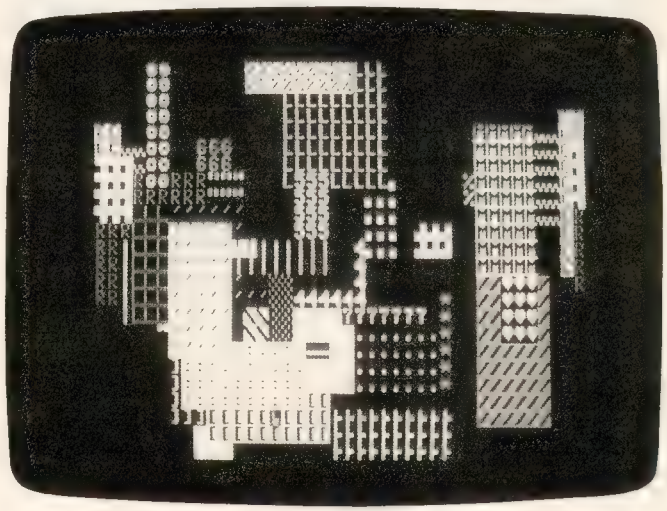
Program length cannot be equated with program quality. You might remember your first efforts at BASIC programming, and in looking back see how much more efficient and effective your programming methods could have been. Sometimes, just a few lines can go a long way.

In this series, we'll look at some programs which are designed to show off the graphics and sound capabilities of the 64. You'll notice that each of the programs is short and to the point. This makes the listings easier to understand so you can see what's happening and incorporate the ideas into your own programs. Or experiment with these short programs, expanding them to do more.

This month, the four selections are graphics programs: "Quilt," "Double Diamond," "Tunnels," and "Christmas Tree." As the series continues, you might want to experiment by combining sound from one program (we'll look at sound programs next month) with graphics from another. Most of the programs involve POKEing characters to the screen in visually pleasing patterns and colors. Feel free to substitute your own characters, colors, or limits. It's best to have a color TV or monitor.

Quilt

This ten-line program produces a multicolor patchwork quilt which changes repeatedly until you press RUN/STOP–RESTORE. Let's look at the program to see how it works.



Line 10 clears the screen (CHR$(147)), changes the character color to white (CHR$(5)), and makes the background and border colors black (POKE 53280,0 and 53281,0). In line 20, R is the amount to be added to screen memory locations to get the corresponding color memory locations. A is the increment.

Line 30 and the first half of line 40 choose random sizes of blocks to be "painted." In the last half of line 40, a random character (M) is chosen to paint the blocks.

Lines 50 and 60 make sure the selected block will fit on the screen; if not, another size is

chosen.

Lines 70–100 perform the painting of the blocks. A loop within a loop paints a block of size N characters by P characters in color Q starting at location V. Line 100 then jumps back to restart the process.

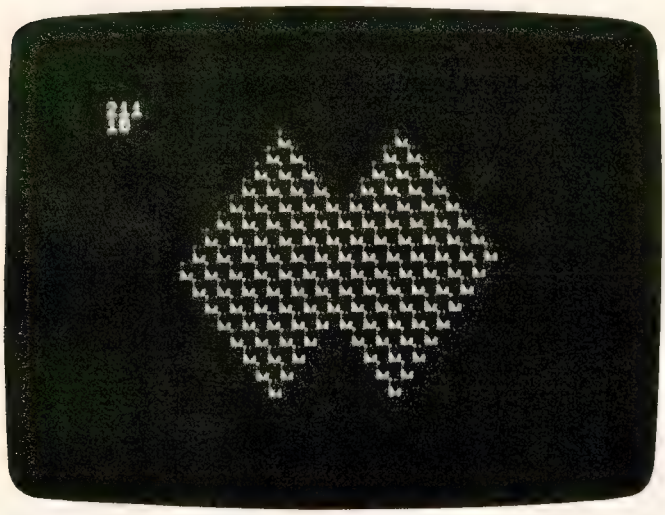
Double Diamond

This program's a bit longer (23 lines), but the effect is quite nice. It draws two superimposed diamonds of random characters and colors.

Let's look at the key lines. Lines 30 and 40 contain values for the location of the diamonds (V and W) and for the creation of the diamonds within diamonds (S and U).

Line 50 picks a random color (T).

Lines 60–120 POKE random characters and colors to the screen and increment the position of characters by A, B, C, and D to produce diagonal motion to form the left diamond. Lines 150–200



do the same for the right diamond.

Each of the diamonds (V and W) is limited in size in lines 130 and 210. Lines 220 and 230 pause then loop back to create new diamonds. Again, to stop the program, press RUN/STOP–RESTORE.

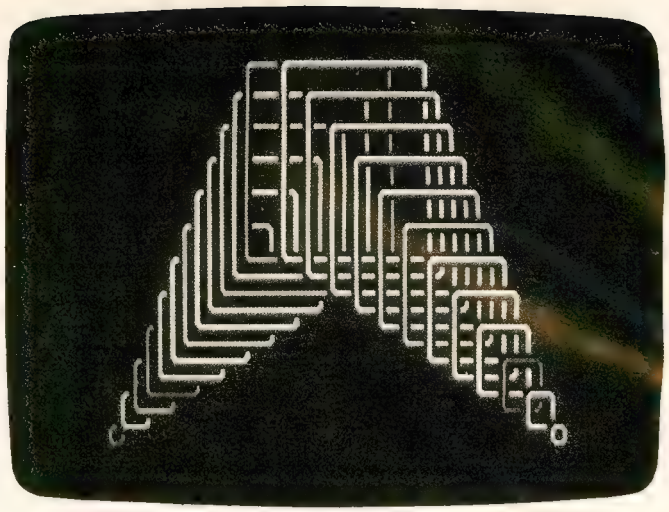
Tunnels

Probably the most interesting visual effect this month is "Tunnels."

Line 20 sets up variables for drawing the rectangles and starts at screen location 1984. Lines 30 and 70 control the number of rectangles drawn in each loop.

Lines 40, 60, and 80 determine the rectangles' positions and increase their size by one as they are drawn.

The rectangles are created in lines 120–190. Numbers 66 and 67 are the values to POKE for vertical and horizontal lines, and 73, 74, 75, and



85 are the POKE values for the four corners of each rectangle.

Christmas Tree

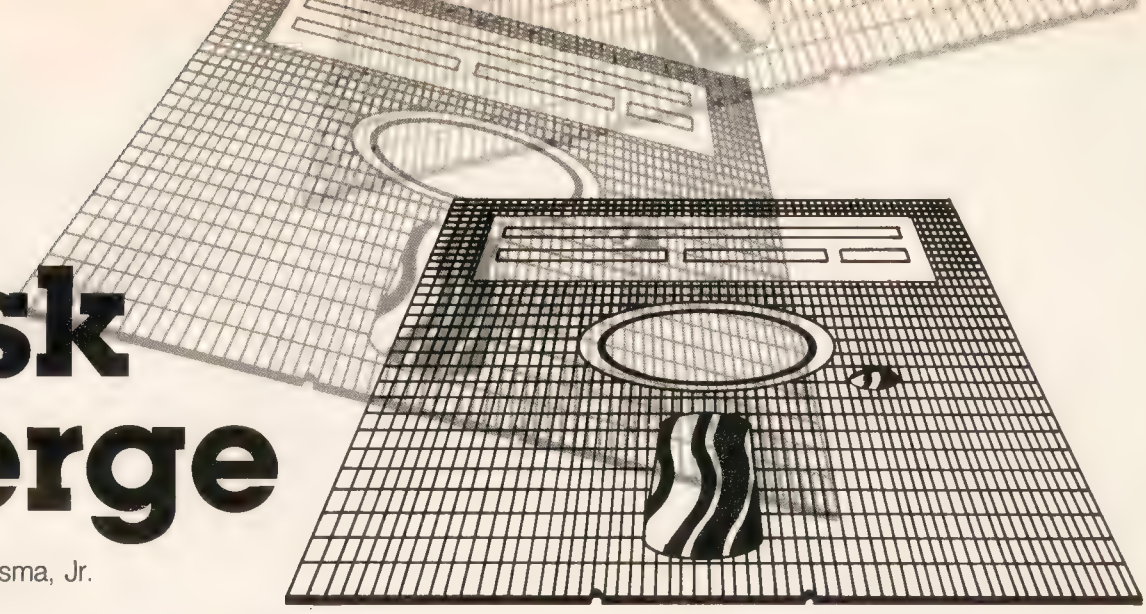
Finally, let's do a program in the holiday spirit. "Christmas Tree" draws a twinkling tree formed of "lights" which randomly turn on until the tree is completely filled. It then continues twinkling until you press RUN/STOP–RESTORE.

If you'd like to change the shape of the tree, be sure to change the 156 in lines 40–60 to the total number of spots you want to light up.

Line 90 POKEs the random spot with an asterisk (#42) and its corresponding color memory location with a random color code from 1 to 14 (omitting black and light gray). The DATA statements in lines 110–360 are the actual screen locations for the asterisks to be POKEd.

Feel free to experiment with the variables in these programs and see what interesting modifications you can come up with. Next month, we'll look at some programs which integrate sound and graphics.

See program listings on page 160.



Disk Merge

Robert D. Riemersma, Jr.

A disk full of useful subroutines can be a great help when you're writing a program. But to be truly useful, two or more might need to be merged. This utility does it for you. For the VIC or 64, with a disk drive.

"Disk Merge" does just what its name says. It reads two BASIC programs from a disk and merges them into a new file on the disk. To merge more than two programs, run it more than once.

A simple appending program (see the February 1984 GAZETTE Feedback for an example) will add one program to the end of another. A merge program is more sophisticated. It must look at the line numbers and insert them in their proper place, as if shuffling a deck of cards.

Four Questions

Type in and save the program. Before running it, make sure the two programs to be merged are on the same disk. They must be PRG (program) files. Disk Merge won't work on sequential or relative files. It's a good idea to turn off any other peripherals, especially printers.

Run it and you'll be asked four questions. (The STOP key is disabled during input, so if you want to escape the program, type the asterisk (*) and press RETURN.)

Primary File?

Enter the name of the primary file you'll be merging. Keep in mind that if the two programs have a line number in common, the primary file takes precedence. For example, if they both include a line numbered 210, only the line from the primary file will appear in the final merged program.

If you have a dual disk drive, you can include the drive number by entering a quotation mark, drive number, colon, and the filename. This allows you to merge programs from two different disks. Note that this doesn't apply if you own two 1541s (device 8 and device 9). It will only work with a dual drive (drive 0 and drive 1) such as the Commodore 4040 or an MSD. With 1541s, the two programs must be on the same disk.

Secondary File?

Answer this question with the name of the second program, the one which will be merged into the first.

Merged File?

Enter a name for the new program, the output file.

Base Address? 1025

The VIC-20 and 64 automatically relocate BASIC programs on a standard LOAD, so it doesn't really matter what the number is. Simply press RETURN. However, if you want the program to work on a PET/CBM, the base address 1025 will create a program that runs on the VIC, 64, or PET/CBM models (within the usual limits of compatibility).

After answering the questions, two things will happen. You'll see the disk drive's red light turn on, and numbers will appear on the screen. The numbers tell you which line is being processed and written to disk.

On the left, you'll see the primary file's current line number. On the right is the line being merged from the secondary file.

When the program ends, you have two options. You can run it again (to merge more programs), or load the newly merged program, which should be ready to run. On large programs, the merge may take several minutes.

See program listing on page 172.

COMPUTE!'s GAZETTE Back Issues

JULY 1983: Commodore 64 Video Update; Snake Escape; Alfabug; VIC Marquee; Word Hunt; Learning To Program In BASIC; Quickfind; 64 Paddle Reader; Machine Language For Beginners; Enlivening Programs With Sound; Using Joysticks On The 64.

OCTOBER 1983: The Anatomy of Computers; Telegaming Today And Tomorrow; Commodore's Public Domain Programs; Oil Tycoon; Re-Beep; Aardvark Attack; Word Match; Machine Language For Beginners; How To Use Tape And Disk Files; Understanding 64 Sound; Speeding Up The VIC; HOTWARE; Improving 64 Video Quality; Using The VIC's Clock.

MARCH 1984: The Electronic Castle: Managing Your Home With Your Computer; Getting Started With A Disk Drive, Part 5; CUT-OFF!; Poker; Tree Tutor For Tots; Guess America!; Sea Route To India.

APRIL 1984: Robots: The New Mobile Computers; How To Start A User Group; Bingo 64; Making Calendars; French Tutor; Hints & Tips: Adding A Second Joystick To The VIC; Power BASIC: Numeric Keypad.

MAY 1984: Exploring 64 Sound; SpeedScript Revisited; Sound Sculptor For The 64; Props; Mind Boggle; Memo Writer; The Beginner's Corner: Teaching Music With Computers.

JUNE 1984: The Future Of Computer Games: Software That Thinks For Itself; 3-D Tic-Tac-Toe; Castle Dungeon; Therapy; File Copier; Power BASIC: One-Touch Keywords; The Beginner's Corner: Planning A Game Program.

JULY 1984: In Touch With Your Computer: Graphics Tablets And Light Pens; Space Patrol; Robot Math; Ultrafont +; Machine Language For Beginners: What Is Machine Language?; The Beginner's Corner: Quilt Squares.

AUGUST 1984: A Survey Of Printers For The VIC And 64; Selecting A Printer Interface; Campaign Manager; Sprite Magic; Balloon Blitz; Disk Purge; The Beginner's Corner: Using A Printer.

Issues not listed are not available.

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NEWS & PRODUCTS

VIC, 64 Interfaces

Omnitronix Incorporated has released two interfaces for use with the VIC-20 or Commodore 64.

The parallel printer interface connects to the user I/O port on either the VIC-20 or the 64 and comes with a driver software disk which allows CBM printer emulation, such as tabbing.

Printers without bitmap graphics capability can print Commodore graphics and control codes in the form of mnemonics or the CHR$ code.

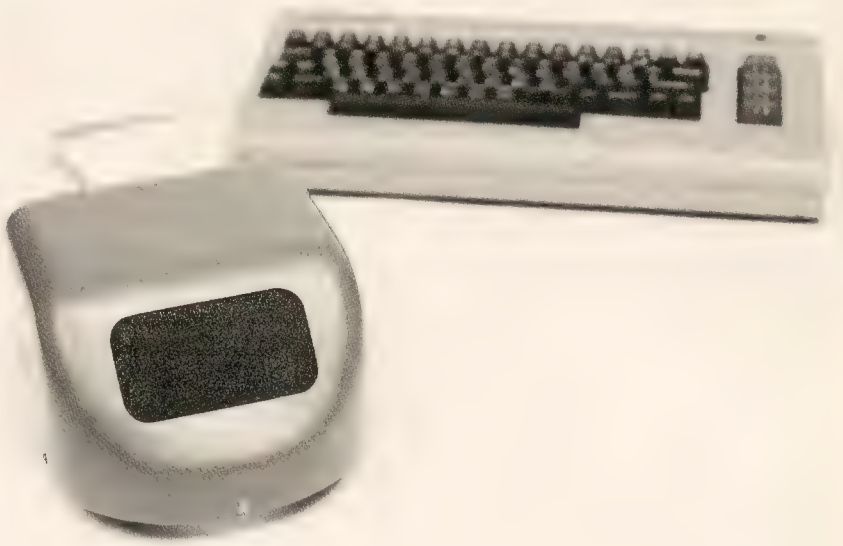
Suggested retail price is $39.95.

The second interface, the Deluxe RS-232 Interface, which also plugs into the user I/O port, provides many RS-232 signals, including ring detect. It has three user-selectable switches allowing settings for DTE/DCE, pin 5, or pin 20 handshaking, and selection of a BUSY line polarity.

The interface comes with either a male DB25 on a three-foot cable or a PCB mounting female DB25, making it compatible as a replacement for the Commodore 1011A.

Included in the $39.95 retail price is a BASIC terminal program which can be typed in.

Omnitronix Incorporated
P.O. Box 43
Mercer Island, WA 98040
(206) 236-2983



The NOMAD personal robot for the Commodore 64 retails for $179.95.

Personal Robot For 64s

Genesis Computer Corporation has introduced NOMAD, a personal robot for use with the Commodore 64.

NOMAD is driven by stepper motors, and can move forward, reverse, right, and left. It has ultrasonic "eyesight" which allows it to detect objects in its path.

NOMAD's robot control language allows the user to create complex patterns of movement. The robot also can be controlled through a joystick. NOMAD plugs into the 64's user port and comes with its own power supply and a 25-foot cord.

An optional BASIC enhancement cartridge is available which adds NOMAD control commands such as AHEAD, BACK, LEFT, and RIGHT.

NOMAD has a suggested retail price of $179.95. The BASIC cartridge retails for $39.95.

Genesis Computer Corporation
1444 Linden Street
P.O. Box 1143
Bethlehem, PA 18018
(215) 861-0850

64 Productivity Software

PFS:FILE and *PFS:REPORT*, previously available only for IBM and Apple computers, have

been released for the Commodore 64 by Software Publishing Corporation.

PFS:FILE works like a paper filing system, allowing the user to record, retrieve, update, and review information. Data can be organized on forms which are user-designed.

PFS:REPORT sorts, calculates, formats, and prints summary tables from the information in files created with *PFS:FILE*. It prints multiple columns per report, including three calculated columns.

Totals, subtotals, averages, subaverages, counts, and subcounts can be printed for every column. The software also has sorting capabilities, as well as automatic page numbering, title printing, and centering.

PFS:FILE retails for $79.95. *PFS:REPORT* is available for $69.95.

Software Publishing Corporation
1901 Landings Drive
Mountain View, CA 94043
(415) 962-8910

Real Estate Game, Hardware For VIC And 64

Real Estate 64, a Monopoly-type game with 3-D graphics for the Commodore 64, has been introduced by Handic Software.

The firm also has introduced Vic-Switch, a multi-user disk system for the VIC and 64; Super Box 64, an expansion unit for the 64; and a 300 baud modem.

Real Estate 64, available on disk for $49.95, includes traditional Monopoly features such as buying streets, going to jail, chance, and the use of dice.

The Vic-Switch was developed for educational use, but can be used in any situation where more than one person needs access to the same disk or printer. Up to eight VIC-20s or C-64s can be hooked up to one Vic-Switch. All CPUs have access to disk drive and printer. Retail price is $149.95.

The Super Box 64 allows up to three cartridges to be plugged in simultaneously. Other features include an IEEE interface, reset function, and multi-user capabilities. It retails for $149.95.

The 300-baud modem ($149.95) is switch controlled, allowing either originate or answer options. It connects to the user port of the VIC or 64.

Handic Software Inc.
520 Fellowship Road
Mount Laurel, NJ 08054
(609) 866-1001

VIC-20 Keyboard Program Module

Micromechanisms, Inc. has introduced a Keyboard Program Module which, when combined with a VIC-20, creates a multi-function ASCII encoded keyboard for use with more sophisticated computers.

The plug-in module does not physically modify the VIC-20, allowing the computer to continue to run applications and games. The module also converts VIC function keys into special character codes required by the *Wordstar* word processor.

Suggested retail price is $35.

Quality Electronics Inc.
Micromechanisms Division Inc.
P.O. Box 1150
112 Maple Avenue
Dublin, PA 18917
(215) 249-0331

The address and telephone numbers for Mosaic Electronics, maker of the *Access-M* memory expansion system for the Commodore 64, is P.O. Box 708, Oregon City, OR, 97045; (toll free) 1-800-2ADD-RAM or (503) 653-7885. The information was inadvertantly omitted from the December *News & Products* section.

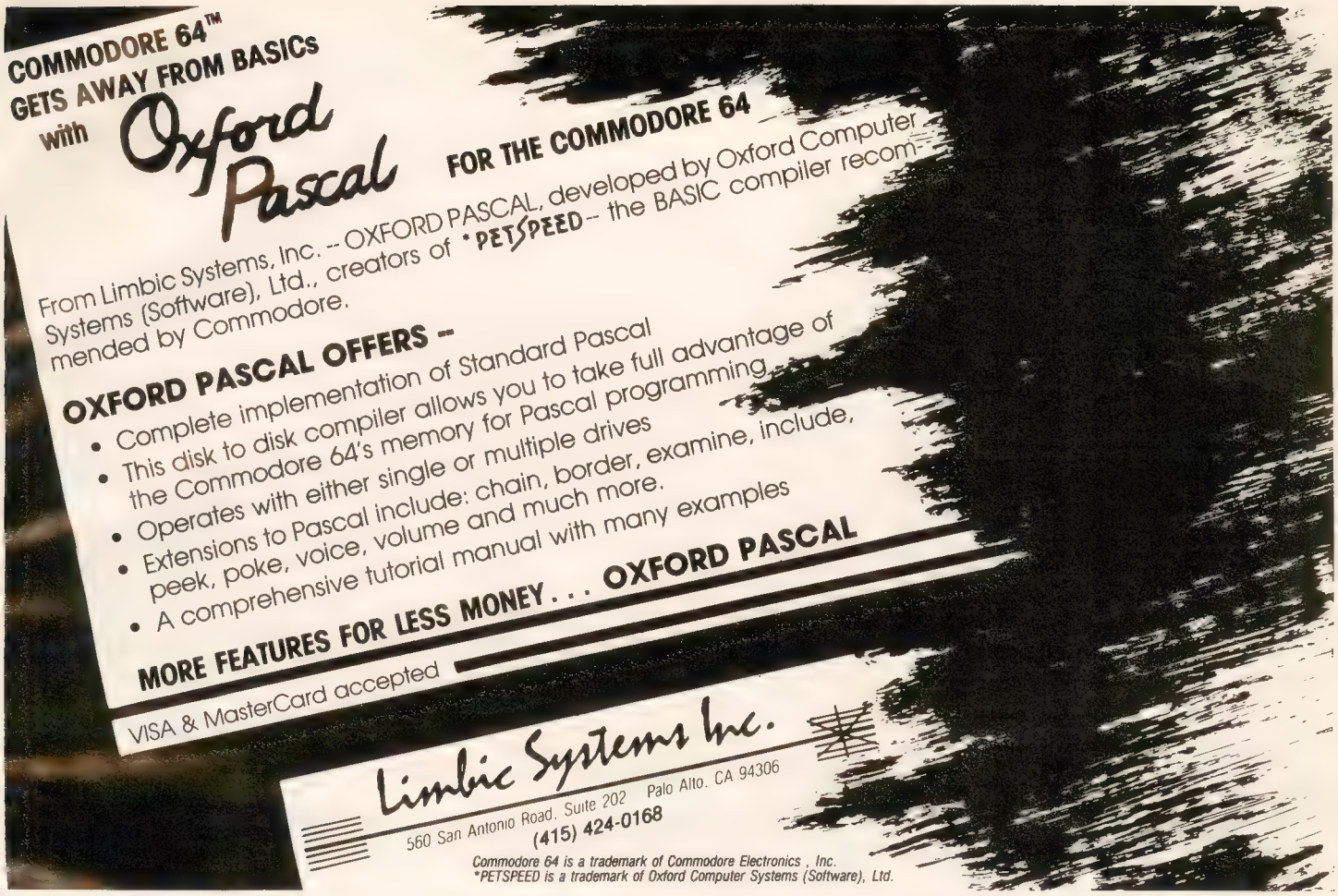
New Educational Software Series For The 64

Orbyte Software has introduced a line of 56 home educational software titles—*Challengeware*—for the Commodore 64.

Geared primarily for children from pre-school through upper elementary grades, the 110 programs are divided into nine areas: pre-school concepts, mathematics, grammar, science, social studies, economics, reading, foreign language, and logic and strategy.

The programs retail for $39.95 each.

Orbyte Software
P.O. Box 948
Waterbury, CT 06720
(203) 621-9361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FOR THE COMMODORE 64
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(415) 424-0168
Commodore 64 is a trademark of Commodore Electronics , Inc.
*PETSPEED is a trademark of Oxford Computer Systems (Software), Ltd.

Biofeedback, Utility Programs For 64

The Stress Manager, a biofeedback monitoring system, and *HomePak*, a utility program, have been introduced for the Commodore 64 by Batteries Included.

The *Stress Manager* allows home computer owners to assess their thought patterns and physiological impulses in order to gain an understanding of factors which contribute to stress.

It uses a galvanic skin resistance (G.S.R.) method to measure a user's vital statistics. A pair of fingertip pads measure fluctuations in the skin's electrical conductivity, and these impulses are transmitted to *The Stress Manager* for analysis.

After the results are interpreted, they are displayed on three graphs. Another feature is an audio cassette, which includes methods of relaxation and stress reduction.

Suggested retail price is $79.95.

HomePak combines on one disk a telecommunications terminal program, an information management system, and a word processor for a suggested retail price of $49.95.

Each of the *HomePak* programs is capable of reading files created by the others.

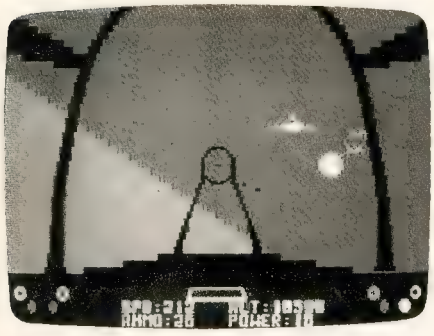
HomeTerm, the telecommunications program, features a text edit window which is available for simultaneous text creation and reception. The user can define screen color, text margins, word wrapping, and key clicking (each keystroke made audible with a beep). An on-screen clock keeps track of the time elapsed since the user logged onto a bulletin board or information service.

HomeFind, the information manager program, features an English command structure to simplify use. Printed reports from *HomeFind* can be used by the *HomeText* word processing program.

HomeText features include the ability to set margins, indentations, line centering and spacing, and placement of headers, footers, and page numbers.

It also has the ability to delete portions of text and reinsert them at any point within the text body. *HomeText* is capable of supporting most major printing functions, including boldface, underlining, and extended character width.

Batteries Included
3303 Harbor Blvd., Suite C9
Costa Mesa, CA 92626
(714) 979-0920



A scene from Spitfire Ace, *a new flight simulation game from MicroProse.*

Spitfire Ace For 64

MicroProse Software has announced *Spitfire Ace*, a World War II fighter pilot simulation game, for the Commodore 64.

Players maneuver their aircraft through a series of fighter tactics, including aileron rolls, loops, split S's, and Immelmann turns, while engaged in an aerial dogfight.

Suggested retail price for *Spitfire Ace* is $29.95.

MicroProse Software
10616 Beaver Dam Road
Hunt Valley, MD 21030
(301) 667-1151

Art Heist Game

The Heist, a disk-based game for the Commodore 64 which features 90 different booby trapped rooms, has been introduced by the MicroFun division of MicroLab.

The rooms are on three different levels of an art gallery, and super spy Graham Crackers must maneuver through them in order to steal the gallery's entire collection.

Terrorists have hidden doomsday plans, concealed on a microdot, on one of the pieces of art in the gallery. You must find it in time to avoid destruction.

Suggested retail price is $35.

MicroFun
2699 Skokie Valley Road
Highland Park, IL 60035
(312) 433-7550

Commodore Voice Command Module

ENG Manufacturing, Inc. has introduced Chirpee, a module which allows Commodore computers to receive and interpret selected commands.

According to product developers, Chirpee can accept commands spoken in any language because of its phonetic recognition ability, and can be trained to respond to one voice, or a number of voices.

Suggested retail price for Chirpee is $179.95.

ENG Manufacturing, Inc.
4304 W. Saturn Way
Chandler, AZ 85224
(602) 961-0165

64 Math Game

Divex, a math game designed to improve children's understanding of multiplication and division, has been introduced by Intelligence Quest Software, a division of The Avalon Hill Game Company.

The game contains three difficulty levels. The player, at the controls of a laser cannon, must choose between correct and incorrect answers by destroying the wrong answers before they can touch down.

In all cases, when the player destroys a correct answer by mistake, the computer will sound out and flash the correct answer on the screen.

Divex is designed for children 8–12 years old. Suggested retail price is $16 for the cassette version, and $21 for the disk.

Intelligence Quest Software
The Avalon Hill Game Company
4517 Harford Road
Baltimore, MD 21214
(301) 254-5300

64 Advertising Display Program

AdvertiserOne, a program to display user-designed messages on the Commodore 64, has been announced by MicroAds.

The display messages are generated and maintained with the Commodore 64's standard screen editor. Displays can be based on message files and a standard command file which comes with the system, or with a user-created command file that can control the sequence, color, and text of the displays.

Message display features include: heading, subheading, and main message areas; ability to

change heading, subheading, and main message text at any time; use of multiple message text and background colors; automatic text centering; and sprite graphic designs.

Suggested retail price is $19.95.

MicroAds
145 East Norman Drive
Palatine, IL 60067
(312) 991-9415

Typing Program For 64

Typetown Races, a touch typing tutorial for the Commodore 64, has been introduced by Softech.

The program, first in a series of self-improvement packages from Softech, contains more than 100 lessons, all of which are designed to teach touch typing. Included are the complete upper- and lowercase alphabetic, numeric, and special character keys. Users can progress at their own speed.

Typetown Races is available on disk for $24.95.

Softech
26 Sugar Maple Street
Kitchener, Ontario
N2N 1X5
Canada
(519) 744-5586

New product releases are selected from submissions for reasons of timeliness, uniqueness, available space, and general interest. Readers should be aware that News & Products often contains an edited version of material submitted by vendors. We are unable to vouch for its accuracy at time of publication.

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TOO NEW FOR PICTURES ! !

In a last minute Christmas coup, **British Intelligence** has snagged the rights to Europes most popular graphic Adventures. **BASTOW MANOR:** A cult game in Europe and Australia. **SUPER SLUETH:** A Sherlock Holmes type Adventure. **NUCLEAR-WARGAMES:** A supercomputer wants to start WW III.

Phone or write for complete descriptions.

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QUEST - A different kind of Graphic Adventure. it is played on a computer generated mape of Alesia You'll have to build an army and feed them through combat, bargaining, exploration of ruins and temples, and outright banditry! Takes 2 - 5 hours to play and is different each time

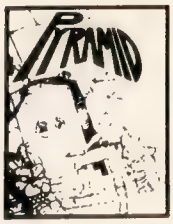
Available On TRS80C 16K, CMD64, MC10 16K, IBM PC 16K, TI99 (EXT BASIC), IBMPC

TAPE $14.95 DISK $18.95

MARS - Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian City, repair your ship, and deal with possibly hostile aliens to get home again. This is recommended as a first Adventure. It is in no way simple - playing time normally runs from 30 to 50 hours, but it lets you try out Adventuring before you battle the really tough ones. Full Graphics Adventure.

Available On TRS80C, CMD 64, IBM PC

TAPE $19.95 DISK $24.95



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How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the VIC-20, Commodore 64, Plus 4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. Also, carefully read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We publish two programs, appearing in alternating months, designed to make your typing effort easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 spaces} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + CRSR ↕	
{DOWN}	CRSR ↕	
{LEFT}	SHIFT + CRSR ↔	
{RIGHT}	CRSR ↔	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{F1}	f1	
{F2}	SHIFT + f1	
{F3}	f3	
{F4}	SHIFT + f3	
{F5}	f5	
{F6}	SHIFT + f5	
{F7}	f7	
{F8}	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↕	

For Commodore 64 Only

When You Read:	Press:	See:
[1]	C= + 1	
[2]	C= + 2	
[3]	C= + 3	
[4]	C= + 4	
[5]	C= + 5	
[6]	C= + 6	
[7]	C= + 7	
[8]	C= + 8	

The Automatic Proofreader

"The Automatic Proofreader" will help you type in program listings from COMPUTE!'s Gazette without typing mistakes. It is a short error-checking program that hides itself in memory. When activated, it lets you know immediately after typing a line from a program listing if you have made a mistake. Please read these instructions carefully before typing any programs in COMPUTE!'s Gazette.

Preparing The Proofreader

1. Using the listing below, type in the Proofreader. The same program works on both the VIC-20 and Commodore 64. Be very careful when entering the DATA statements — don't type an l instead of a 1, an O instead of a 0, extra commas, etc.

2. SAVE the Proofreader on tape or disk at least twice *before running it for the first time.* This is very important because the Proofreader erases this part of itself when you first type RUN.

3. After the Proofreader is SAVEd, type RUN. It will check itself for typing errors in the DATA statements and warn you if there's a mistake. Correct any errors and SAVE the corrected version. Keep a copy in a safe place — you'll need it again and again, every time you enter a program from COMPUTE!'s Gazette.

4. When a correct version of the Proofreader is RUN, it activates itself. You are now ready to enter a program listing. If you press RUN/STOP-RESTORE, the Proofreader is disabled. To reactivate it, just type the command SYS 886 and press RETURN.

Using The Proofreader

All VIC and 64 listings in COMPUTE!'s Gazette now have a *checksum number* appended to the end of each line, for example ":rem 123". *Don't enter this statement when typing in a program.* It is just for your information. The rem makes the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will confuse the Proofreader, even if you entered the rest of the line correctly.

When you type in a line from a program listing and press RETURN, the Proofreader displays a number at the top of your screen. *This checksum number must match the checksum number in the printed listing.* If it doesn't, it means you typed the line differently than the way it is listed. Immediately recheck your typing. Remember, don't type the rem statement with the checksum number; it is published only so you can check it against the number which appears on your screen.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. But occasionally proper spacing *is* important, so be extra careful with spaces, since the Proofreader will catch practically everything else that can go wrong.

There's another thing to watch out for: if you enter the line by using abbreviations for commands, the checksum will not match up. But there is a way to make the Proofreader check it. After entering the line, LIST it. This eliminates the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way.

Special Tape SAVE Instructions

When you're done typing a listing, you must disable the Proofreader before SAVEing the program on tape. Disable the Proofreader by pressing RUN/STOP-RESTORE (hold down the RUN/STOP key and sharply hit the RESTORE key). This procedure is not necessary for disk SAVEs, *but you must disable the Proofreader this way before a tape SAVE.*

SAVE to tape erases the Proofreader from memory, so you'll have to LOAD and RUN it again if you want to type another listing. SAVE to disk does not erase the Proofreader.

Since the Proofreader is a machine language program stored in the cassette buffer, it will be erased during a tape SAVE or LOAD. If you intend to type in a program in more than one sitting or wish to make a safety SAVE, follow this procedure:

1. LOAD and RUN the Proofreader.
2. Disable it by pressing RUN/STOP–RESTORE.
3. Type the following three lines in direct mode (without line numbers):

```
A$="PROOFREADER.T":B$="{10 SPACES}":FO
RX=1TO4:A$=A$+B$:NEXTX
FORX=886 TO 1018:A$=A$+CHR$(PEEK(X)):N
EXTX
OPEN1,1,1,A$:CLOSE1
```

After you type the last line, you will be asked to press RECORD and PLAY. We recommend you start at the beginning of a new tape.

You now have a new version of the Proofreader (PROOFREADER.T, as renamed in the above code). Turn your computer off and on, then LOAD the program you were working on. Put the cassette containing PROOFREADER.T into the tape unit and type:

OPEN1:CLOSE1

You can now get into the Proofreader by typing SYS 886. To test this, PRINT PEEK (886) should return the number 173. If it does not, repeat the steps above, making sure that A$ (PROOFREADER.T) contains 13 characters and that B$ contains 10 spaces.

The new version of Automatic Proofreader will load itself into the cassette buffer whenever you type OPEN1:CLOSE1 and PROOFREADER.T is the next program on your tape. It will not disturb the contents of BASIC memory.

Automatic Proofreader For VIC And 64

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO
    1018:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MAD
    E AN ERROR":PRINT"IN DATA STATEMENTS.
    ":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER
     ACTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Bug-Swatter:
Modifications And Corrections

• Programs 2 and 3 from "Machine Language For Beginners" (November 1984) were inadvertently omitted from the "Program Listings" section. They are the BASIC loader programs (the equivalent of the source code included in the article) which were mentioned on page 132. The two programs follow:

VIC Memory Display

```
800 FOR ADRES=830TO859:READ DATTA
810 POKE ADRES,DATTA:NEXT ADRES
830 DATA 169, 5, 160, 0, 153, 0
836 DATA 148, 153, 0, 149, 136, 208
842 DATA 247, 162, 0, 181, 0, 157
848 DATA 0, 16, 189, 0, 2, 157
854 DATA 0, 17, 202, 76, 77, 3
```

64 Memory Display

```
800 FOR ADRES=830TO877:READ DATTA
810 POKE ADRES,DATTA:NEXT ADRES
830 DATA 169, 7, 160, 0, 153, 0
836 DATA 216, 153, 0, 217, 153, 0
842 DATA 218, 153, 0, 219, 136, 208
848 DATA 241, 162, 0, 181, 0, 157
854 DATA 0, 4, 189, 0, 2, 157
860 DATA 0, 5, 189, 0, 208, 157
866 DATA 0, 6, 189, 0, 220, 157
872 DATA 0, 7, 202, 76, 83, 3
```

• Last month, we published a suggestion from a reader in Gazette Feedback ("An End To Disk Drive Chatter"). Several readers called to inform us that it sometimes doesn't work with *Easy Script*, and that their drives wouldn't read any files even after turning the drive off and on. No cause for alarm, however. We duplicated the problem once, and the drive locked up (although subsequent tests worked fine, eliminating disk drive chatter). Although the suggested technique works with most commercial programs, if your drive should lock up, the solution is to initialize the drive with this command:

OPEN15,8,15,"I0":CLOSE15.

• The article for "Screen-80" (September 1984) stated that the program was compatible with the terminal software packaged with the 1650 Automodem. It *is* compatible, except that you can't use the function keys to change terminal parameters. If you want to be able to change parameters, follow this procedure:

1. Load *64 Term*

2. Type this line (in immediate mode):

POKE44,64: POKE 16384,0: NEW

3. Enter this short program to modify *64 Term:*

```
10 FORT=4634TO4644:READD:POKET,D:NEXT
20 DATA 32,198,2,169,14,32,210,255,76,229
   ,14
30 POKE2283,76:POKE2284,26:POKE2285,18
40 POKE45,38:POKE46,18:POKE44,8:CLR
```

If the label on your terminal software says *Autoterm,* don't use the above program. Instead, enter this one:

```
10 FOR T= 5633TO5643:READD:POKET,D:NEXT
20 DATA 32,198,2,169,14,32,210,255,76,87,
   16
30 POKE2664,76:POKE2665,1:POKE2666,22
40 POKE45,13:POKE46,22:POKE44,8:CLR
```

4. Type RUN. The above program makes some modifications to *64 Term.*

5. Save this new version to a new disk or tape (be sure to keep the original *64 Term*).

Once you've created the new *64 Term,* you can load and run Screen-80. Get out of 80-column mode with RUN/STOP–RESTORE. Next, load and run the modified *64 Term.* Change the parameters, using f4. When finished, press the E key. Instead of exiting to BASIC, you'll enter terminal mode (with 80-columns) with the new parameters set. We have tested these two modifications with different versions of *64 Term* and *Autoterm.* There may, however, be other versions of these two programs, and Commodore may make changes in the future.

Readers might also note that our sister magazine, COMPUTE!, is planning to run a terminal program in the first few months of 1985. This program will be compatible with Screen-80, and can be used to access standard-ASCII bulletin boards and information networks.

• Reader Barry Friedman has pointed out an error in the "Gazette Feedback" item "PEEKing The Joystick" (November 1984). The example on page 12 should read IF (PEEK(56320)AND16)=0 THEN PRINT "FIRE". The "=0" is important because joystick movements turn bits off (making them zero) rather than turning them on.

• There are no errors in the "Turtle Graphics" programs from October 1984; however, the article contained some typographical errors on page 93, under "How It Works". The start of BASIC is moved up to $4000, leaving $0800–$3FFF free (not $0800–$03FF). The sprite definitions do not go into the last 512 bytes of this free area—they are put into $0E00–$0FFF (decimal 3584–4095).

Tiny MLX Machine Language Entry Program

For Unexpanded VIC-20

Charles Brannon, Program Editor

Note To Readers

This is the final appearance of Tiny MLX in the Gazette. In order to better use space in the magazine and to help eliminate confusion for those typing in programs, all VIC machine language programs listed in MLX format will require VIC MLX. MLX, both VIC and 64 versions, will appear in alternate months. The use of VIC MLX requires 8K memory expansion, although expansion is often not required to run an MLX-entered VIC program (notes are always included in the article).

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!'s GAZETTE. You need to know nothing about machine language to use MLX—it was designed for everyone. "Tiny MLX" is a special version for the unexpanded VIC.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save "Tiny MLX" (you'll want to use it in the future). When you're ready to type in an ML program, run Tiny MLX. Unlike regular MLX, Tiny MLX does not ask for the starting and ending address of the program to be entered. Instead, this information must be included in line 210. The values currently shown in line 210 are for the "Kablam!" program in this issue. It's also necessary to change lines 100 and 763 to use Tiny MLX with Kablam!, so be sure to check these lines if you're using an earlier version of Tiny MLX. Refer to the article on page 60 for details.

You'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the comma, space bar, or RETURN key to advance to the next numbr. The checksum automatically appears in reverse video for emphasis.

MLX Commands

When you finish typing an ML listing, you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you made a typo when entering the MLX program itself.

Since Tiny MLX has no provisions for reloading a partially completed program, you must enter the ML program all in one sitting.

See program listing on page 173.

All programs listed in this magazine are available on the GAZETTE Disk. See elsewhere in this issue for details.

Telecommunications Software

The listing below is the second half of the C/G Bulletin Board System. Part 1 and the article with instructions on use were published last month. Do not enter Part 2 until you have completed typing in Part 1 and you understand the procedure as outlined in the Commands section of the MLX article published last month. Load MLX, and use a starting address of 2049 and an ending address of 17828. Then type SHIFT-L to load Part 1 and begin entering the listing below.

Note To Readers And Disk Subscribers

The C/G Bulletin Board as listed in this and the December issues, and as published on the December disk, runs as expected. However, the board can crash if a caller dials the board and hangs up before connecting. We have corrected this problem on the January disk and will publish the correction in next month's "Bug-Swatter." Those typing the program in should not hesitate to continue as the correction will POKE several new values into the final program. Non-disk subscribers who would rather not wait may write or call for the correction.

Also note that all user IDs must start with 1001. They can then run up to 1999. As the system operator, your built-in ID is 1000, but you can't create a user file with this number.

C/G Bulletin Board, Part 2

```
9759 :091,038,169,024,141,043,025
9765 :025,169,065,141,044,025,250
9771 :032,034,025,096,032,091,097
9777 :038,169,030,141,043,025,239
9783 :169,065,141,044,025,032,019
9789 :034,025,096,162,000,138,004
9795 :157,049,072,232,224,007,040
9801 :208,248,096,141,243,071,056
9807 :169,031,141,242,071,032,253
9813 :189,022,173,243,071,096,111
9819 :141,243,071,169,144,141,232
9825 :242,071,032,189,022,173,058
9831 :243,071,096,174,161,069,149
9837 :224,000,208,012,174,014,229
9843 :070,224,000,240,009,206,096
9849 :014,070,198,252,206,161,254
9855 :069,096,096,238,161,069,088
9861 :174,161,069,224,000,208,201
9867 :005,238,014,070,230,252,180
9873 :096,162,000,142,014,071,118
9879 :174,014,071,189,049,072,208
9885 :201,013,240,014,172,161,190
9891 :069,145,251,238,014,071,183
9897 :032,130,038,076,151,038,122
9903 :096,162,000,142,014,071,148
9909 :174,014,071,189,001,072,190
9915 :201,000,240,006,032,199,097
9921 :038,076,181,038,169,032,215
9927 :172,161,069,145,251,238,211
9933 :014,071,032,130,038,096,074
9939 :169,032,032,210,255,096,237
9945 :169,150,133,251,169,082,147
9951 :133,252,160,000,140,161,045
9957 :069,172,161,069,177,251,104
9963 :141,243,071,141,242,071,120
9969 :032,189,022,032,130,038,172
9975 :173,243,071,201,000,208,119
9981 :232,032,120,045.032,048,250
9987 :046,032,004,038,032,176,075
9993 :025,032,189,022,173,242,180
9999 :071,201,048,208,003,076,110
10005 :088,040,041,015,141,031,121
10011 :070,173,144,082,205,031,220
10017 :070,176,006,032,240,037,082
10023 :076,254,038,206,031,070,202
10029 :173,031,070,141,225,080,253
10035 :174,225,080,189,215,080,246
10041 :141,226,080,173,031,070,010
10047 :010,141,145,082,170,189,032
10053 :126,086,141,054,072,238,018
10059 :145,082,174,145,082,189,124
10065 :126,086,141,055,072,173,222
10071 :054,072,141,049,072,032,251
10077 :213,041,173,050,072,141,015
10083 :051,072,173,054,072,041,050
10089 :015,170,189,177,067,141,096
10095 :052,072,173,055,072,141,164
10101 :049,072,032,213,041,173,185
10107 :050,072,141,053,072,173,172
10113 :055,072,041,015,170,189,159
10119 :177,067,141,054,072,174,052
10125 :031,070,189,050,087,141,197
10131 :242,071,024,173,242,071,202
10137 :105,003,141,242,071,172,119
10143 :031,070,190,146,086,142,056
10149 :148,082,024,169,156,109,085
10155 :148,082,141,242,103,133,252
10161 :251,169,086,105,000,141,161
10167 :243,103,133,252,032,237,159
10173 :054,162,002,142,014,071,122
10179 :162,000,142,161,069,142,103
10185 :149,070,142,150,070,032,046
10191 :204,255,172,161,069,177,221
10197 :251,174,014,071,157,226,082
10203 :067,032,210,255,032,130,177
10209 :038,238,014,071,174,014,006
10215 :071,236,242,071,208,228,007
10221 :169,001,174,160,069,160,202
10227 :002,032,186,255,173,014,137
10233 :071,162,226,160,067,032,199
10239 :189,255,032,192,255,173,071
10245 :242,071,162,001,032,198,199
10251 :255,032,204,255,169,004,162
10257 :141,242,071,032,189,022,202
10263 :032,101,022,173,242,071,152
10269 :201,017,208,246,173,051,157
10275 :072,141,242,071,032,189,014
10281 :022,173,052,072,141,242,231
10287 :071,032,189,022,173,053,075
10293 :072,141,242,071,032,189,032
10299 :022,173,054,072,141,242,251
10305 :071,032,189,022,173,226,010
10311 :080,141,242,071,032,189,058
10317 :022,032,101,022,173,242,157
10323 :071,201,003,208,014,032,100
10329 :204,255,169,001,032,195,177
10335 :255,032,089,045,076,228,052
10341 :011,201,027,208,228,162,170
10347 :000,142,148,070,142,149,246
10353 :070,142,150,070,142,147,066
10359 :070,032,120,045,169,058,101
10365 :141,151,070,162,000,142,023
10371 :014,071,032,233,022,173,164
10377 :242,071,174,014,071,157,098
10383 :110,070,238,014,071,032,166
10389 :195,029,173,088,072,201,139
10395 :064,208,008,162,001,142,228
10401 :147,070,076,173,040,174,073
```

```
10407 :014,071,224,036,208,216,168
10413 :169,001,141,161,069,160,106
10419 :000,140,023,070,172,023,095
10425 :070,185,110,070,141,049,042
10431 :072,238,023,070,174,014,014
10437 :071,236,023,070,144,048,021
10443 :032,213,041,173,050,072,016
10449 :174,161,069,157,151,070,223
10455 :141,148,070,238,161,069,018
10461 :032,194,041,173,049,072,014
10467 :041,015,170,189,177,067,118
10473 :174,161,069,157,151,070,247
10479 :141,148,070,238,161,069,042
10485 :032,194,041,076,183,040,043
10491 :173,149,070,141,049,072,137
10497 :032,213,041,173,050,072,070
10503 :174,161,069,157,151,070,021
10509 :238,161,069,173,049,072,007
10515 :041,015,170,189,177,067,166
10521 :174,161,069,157,151,070,039
10527 :238,161,069,173,150,070,124
10533 :141,049,072,032,213,041,073
10539 :173,050,072,174,161,069,230
10545 :157,151,070,238,161,069,127
10551 :173,049,072,041,015,170,063
10557 :189,177,067,174,161,069,130
10563 :157,151,070,238,161,069,145
10569 :169,013,174,161,069,157,048
10575 :151,070,032,204,255,162,185
10581 :000,142,024,070,174,024,007
10587 :070,189,151,070,141,242,186
10593 :071,238,024,070,173,242,147
10599 :071,032,189,022,173,242,064
10605 :071,201,013,208,231,032,097
10611 :101,022,173,242,071,201,157
10617 :027,208,010,174,147,070,245
10623 :224,001,240,021,076,106,027
10629 :040,201,003,208,043,032,148
10635 :204,255,169,001,032,195,227
10641 :255,032,089,045,076,228,102
10647 :011,169,005,141,242,071,022
10653 :032,244,036,169,001,032,159
10659 :195,255,032,101,022,173,173
10665 :242,071,201,017,208,246,130
10671 :032,120,045,076,228,011,175
10677 :201,018,208,006,032,120,254
10683 :045,076,081,041,076,114,108
10689 :041,024,173,148,070,109,246
10695 :149,070,141,149,070,173,183
10701 :150,070,105,000,141,150,053
10707 :070,096,173,049,072,041,200
10713 :240,024,074,074,074,074,009
10719 :170,189,177,067,141,050,249
10725 :072,096,173,049,072,201,124
10731 :058,144,015,041,015,024,020
10737 :105,009,010,010,010,010,139
10743 :141,050,072,076,006,042,122
10749 :041,015,010,010,010,010,093
10755 :141,050,072,096,173,049,072
10761 :072,201,058,144,011,041,024
10767 :015,024,105,009,141,049,102
10773 :072,076,030,042,041,015,041
10779 :141,049,072,173,049,072,071
10785 :013,050,072,141,049,072,174
10791 :096,169,021,141,242,071,011
10797 :032,244,036,032,101,022,000
10803 :173,242,071,201,017,240,227
10809 :007,201,003,208,242,076,026
10815 :088,040,032,101,022,173,007
10821 :242,071,141,051,072,032,166
10827 :101,022,173,242,071,141,057
10833 :052,072,032,101,022,173,021
10839 :242,071,141,053,072,032,186
10845 :101,022,173,242,071,141,075
10851 :054,072,032,101,022,173,041
10857 :242,071,141,226,080,162,003
10863 :000,142,014,071,032,101,215
10869 :022,173,242,071,201,013,071
10875 :240,012,174,014,071,157,023
10881 :121,072,238,014,071,076,209
10887 :115,042,174,014,071,169,208
10893 :087,157,121,072,238,014,062
10899 :071,174,014,071,142,160,011
10905 :072,142,147,082,173,226,227
10911 :080,141,185,103,173,051,124
10917 :072,141,049,072,032,231,250
10923 :041,173,052,072,141,049,187
10929 :072,032,007,042,173,049,040
10935 :072,141,146,072,173,053,072
10941 :072,141,049,072,032,231,018
10947 :041,173,054,072,141,049,213
10953 :072,032,007,042,173,049,064
10959 :072,141,147,072,173,146,190
10965 :072,205,066,104,144,045,081
10971 :173,147,072,205,067,104,219
10977 :144,037,032,204,255,169,042
10983 :094,169,195,032,210,255,162
10989 :169,075,141,043,025,169,091
10995 :068,141,044,025,032,034,075
11001 :025,032,204,255,169,003,169
11007 :141,242,071,032,244,036,253
11013 :076,228,011,056,173,066,103
11019 :104,237,146,072,141,066,009
11025 :104,173,067,104,237,147,081
11031 :072,141,067,104,032,204,131
11037 :255,169,001,174,160,069,089
11043 :160,002,032,186,255,169,071
11049 :010,162,178,160,103,032,174
11055 :189,255,032,192,255,032,234
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16467 :079,077,032,035,062,032,144
16473 :000,013,000,013,032,049,196
16479 :041,032,210,069,065,068,068
16485 :032,077,069,083,083,065,254
16491 :071,069,083,013,032,050,169
16497 :041,032,211,067,065,078,095
16503 :032,077,069,083,083,065,016
16509 :071,069,032,072,069,065,247
16515 :068,069,082,083,013,000,190
16521 :013,211,195,193,206,032,219
16527 :205,197,211,211,193,199,079
16533 :197,032,200,197,193,196,140
16539 :197,210,211,013,013,000,031
16545 :013,066,069,071,073,078,019
16551 :032,087,073,084,072,032,035
16557 :035,032,000,077,069,083,213
16563 :083,065,071,069,032,035,022
16569 :032,000,032,072,065,083,213
16575 :032,066,069,069,078,032,025
16581 :083,069,078,084,046,013,058
16587 :000,197,078,084,082,089,221
16593 :032,000,080,098,001,000,164
16599 :001,013,005,014,018,077,087
16605 :069,083,083,065,071,069,149
16611 :032,035,032,000,079,078,227
16617 :069,032,077,079,077,069,124
16623 :078,084,044,032,080,076,121
16629 :069,065,083,069,046,046,111
16635 :046,000,062,141,000,048,036
16641 :008,048,000,077,083,071,032
16647 :070,073,076,069,049,000,088
16653 :049,058,069,077,065,073,148
16659 :076,084,079,032,000,070,104
16665 :082,079,077,032,000,083,122
16671 :085,066,074,069,067,084,220
16677 :032,000,013,054,052,032,220
16683 :071,082,065,080,072,073,230
16689 :067,083,045,045,013,082,128
16695 :069,065,068,032,065,078,176
16701 :089,087,065,089,063,013,211
16707 :040,089,032,079,082,032,165
16713 :078,041,013,000,082,069,100
16719 :084,085,082,078,032,061,245
16725 :032,078,069,088,084,032,212
16731 :077,069,083,083,065,071,027
16737 :069,013,082,032,061,032,130
16743 :071,079,032,084,079,032,224
16749 :082,069,065,068,032,077,246
16755 :069,078,085,013,077,032,213
16761 :061,032,071,079,032,084,224
16767 :079,032,205,065,073,078,147
16773 :032,205,069,078,085,013,103
16779 :000,082,069,084,085,082,029
16785 :078,032,082,032,077,032,222
16791 :040,063,061,072,069,076,020
16797 :080,041,000,083,069,078,252
16803 :068,032,084,079,032,073,019
16809 :068,035,032,000,212,032,036
16815 :049,041,032,211,084,065,145
16821 :084,085,083,032,207,203,107
16827 :013,032,050,041,032,213,056
16833 :083,069,082,032,068,069,084
16839 :078,073,069,068,032,065,072
16845 :067,067,069,083,083,013,075
16851 :000,032,206,069,087,032,125
16857 :200,065,078,068,076,069,005
16863 :032,000,213,208,196,193,041
16869 :212,197,032,213,211,197,011
16875 :210,032,198,201,204,197,253
16881 :013,000,013,195,200,193,087
16887 :206,199,197,032,213,211,025
16893 :197,210,039,211,013,013,168
16899 :032,049,041,032,208,065,174
16905 :083,083,087,079,082,068,235
16911 :013,032,050,041,032,206,133
16917 :065,077,069,013,032,051,072
16923 :041,032,195,085,077,085,030
16929 :076,065,084,073,086,069,230
16935 :032,084,073,077,069,032,150
16941 :079,078,045,076,073,078,218
16947 :069,032,084,072,073,083,208
16953 :032,077,079,078,084,072,223
16959 :013,032,052,041,032,193,170
16965 :067,067,069,083,083,032,214
16971 :211,084,065,084,085,083,175
16977 :013,032,053,041,032,213,209
16983 :083,069,082,032,198,073,112
16989 :076,069,032,195,079,077,109
16995 :080,076,069,084,069,013,234
17001 :000,213,208,196,193,212,103
17007 :197,032,193,206,207,212,134
17013 :200,197,210,032,198,201,131
17019 :204,197,063,032,040,089,236
17025 :032,079,082,032,078,041,217
17031 :032,000,213,080,068,065,081
17037 :084,069,032,083,089,083,069
17043 :084,069,077,032,070,073,040
17049 :076,069,083,063,032,040,004
17055 :089,032,079,082,032,078,039
17061 :041,000,013,032,049,041,085
17067 :032,085,080,068,065,084,073
17073 :069,032,085,083,069,082,085
17079 :032,070,073,076,069,083,074
17085 :013,032,050,041,032,085,186
17091 :080,068,065,084,069,032,081
17097 :077,069,083,083,065,071,137
17103 :069,032,070,073,076,069,084
17109 :083,013,013,000,013,042,121
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17115 :079,080,069,082,065,084,166
17121 :073,079,078,042,013,042,040
17127 :067,065,078,067,069,076,141
17133 :076,069,068,042,013,000,249
17139 :206,065,077,069,032,000,180
17145 :083,084,082,069,069,084,208
17151 :032,065,068,068,082,069,127
17157 :083,083,032,000,067,073,087
17163 :084,089,044,032,083,084,171
17169 :065,084,069,044,032,090,145
17175 :073,080,032,000,065,082,099
17181 :069,065,032,067,079,068,153
17187 :069,032,000,084,069,076,109
17193 :069,080,072,079,078,069,232
17199 :032,078,085,077,066,069,198
17205 :082,032,000,089,079,085,164
17211 :039,082,069,032,078,079,182
17217 :084,032,082,069,083,080,239
17223 :079,078,068,073,078,071,006
17229 :013,083,079,032,201,039,012
17235 :077,032,072,065,078,071,222
17241 :073,078,071,032,085,080,252
17247 :046,032,194,089,069,000,013
17253 :048,058,084,065,066,076,242
17259 :069,083,032,049,041,032,157
17265 :085,080,068,065,084,069,052
17271 :032,085,083,069,082,032,246
17277 :070,073,076,069,083,013,253
17283 :032,050,041,032,085,080,195
17289 :068,065,084,069,032,068,011
17295 :079,087,078,076,079,065,095
17301 :068,032,077,069,078,085,046
17307 :013,013,000,083,048,058,114
17313 :084,065,066,076,069,083,092
17319 :013,000,042,069,077,080,192
17325 :084,089,042,000,048,049,229
17331 :050,051,052,053,054,055,238
17337 :056,057,065,066,067,068,052
17343 :069,070,036,049,058,068,029
17349 :042,049,041,032,045,045,195
17355 :000,084,089,080,069,032,045
17361 :048,032,070,079,082,032,040
17367 :077,065,073,078,032,077,105
17373 :069,078,085,013,000,049,003
17379 :058,000,000,000,000,000,029
17385 :000,000,000,000,000,000,233
17391 :000,000,000,000,000,000,239
17397 :032,196,207,215,206,204,025
17403 :207,193,196,032,204,201,004
17409 :194,210,193,210,217,013,014
17415 :013,000,013,196,069,083,125
17421 :067,082,073,066,069,032,146
17427 :084,072,069,032,070,073,163
17433 :076,069,013,040,053,048,068
17439 :032,067,072,065,082,065,158
17445 :067,084,069,082,083,032,198
17451 :077,065,088,041,013,000,071
17457 :042,084,082,065,078,083,227
17463 :077,073,083,083,073,079,011
17469 :078,042,001,042,071,065,104
17475 :082,066,076,069,068,042,214
17481 :013,000,013,042,070,073,028
17487 :076,069,032,087,079,078,244
17493 :039,084,032,070,073,084,211
17499 :042,013,000,013,042,083,028
17505 :089,083,079,080,032,073,021
17511 :083,032,079,078,045,076,240
17517 :073,078,069,042,013,000,128
17523 :013,013,212,200,197,032,014
17529 :195,193,204,204,197,210,044
17535 :032,215,193,206,212,211,172
17541 :032,212,207,032,195,200,243
17547 :193,212,013,013,000,013,071
17553 :042,077,065,073,078,084,052
17559 :069,078,065,078,067,069,065
17565 :032,080,069,078,068,073,045
17571 :078,071,042,013,000,013,124
17577 :032,049,041,032,195,072,078
17583 :065,078,071,069,032,080,058
17589 :065,083,083,087,079,082,148
17595 :068,013,032,050,041,032,167
17601 :195,072,065,078,071,069,231
17607 :032,072,065,078,068,076,078
17613 :069,013,032,051,041,032,187
17619 :210,069,084,085,082,078,051
17625 :032,084,079,032,077,065,074
17631 :073,078,032,077,069,078,118
17637 :085,013,013,032,000,069,185
17643 :082,065,083,069,063,032,117
17649 :040,089,032,079,082,032,083
17655 :078,041,000,071,069,084,078
17661 :084,073,078,071,032,078,157
17667 :069,088,084,032,069,077,166
17673 :065,073,076,000,078,079,124
17679 :032,069,077,065,073,076,151
17685 :000,070,073,076,069,078,131
17691 :065,077,069,032,000,013,027
17697 :196,079,069,083,032,089,069
17703 :079,085,082,032,083,089,233
17709 :083,084,069,077,032,072,206
17715 :065,086,069,013,013,032,073
17721 :049,041,032,079,078,069,149
17727 :032,068,082,073,086,069,217
17733 :044,032,035,032,048,044,048
17739 :032,068,069,086,073,067,214
17745 :069,032,056,013,032,050,077
17751 :041,032,084,087,079,032,186
17757 :068,082,073,086,069,083,042
17763 :044,032,035,032,048,044,078
17769 :032,068,069,086,073,067,244
17775 :069,083,032,056,032,065,192
17781 :078,068,032,057,013,032,141
17787 :051,041,032,084,087,079,241
17793 :032,068,082,073,086,069,027
17799 :083,044,032,035,032,048,153
17805 :032,065,078,068,032,049,209
17811 :044,032,068,069,086,073,007
17817 :067,069,032,056,013,013,147
17823 :000,008,013,013,013,013,219
```

All programs listed in this magazine are available on the GAZETTE Disk. See elsewhere in this issue for details.

VIC Magic Draw

Article on page 52.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Magic Draw Boot

```
20 POKE648,30:SYS58648:REM MOVE SCREEN TO
   7680                              :rem 151
25 REM CHANGE ,8 TO ,1 FOR TAPE      :rem 102
30 PRINT"{CLR}{4 DOWN}LOAD"CHR$(34)"MAGIC
   DRAW"CHR$(34)",8{3 UP}"           :rem 203
40 POKE 631,13:POKE198,1:REM AUTOMATIC PR
   ESS RETURN                        :rem 87
50 POKE8192,0:POKE43,1:POKE44,32:NEW: MOV
   E BASIC TO 8192                   :rem 193
```

Program 2: Magic Draw

Note: Requires at least 8K expansion.

```
50 IFPEEK(648)<>30THENPRINT"{CLR}{DOWN}SE
   T SCREEN AND BASIC":END           :rem 127
60 PRINT"{CLR}":POKE36878,15:GOSUB970
                                     :rem 47
90 POKE36867,149:POKE36869,252:POKE36879,
   233                               :rem 236
100 FORI=0TO7:P%(I)=2↑(7-I):NEXT     :rem 149
120 FORI=0TO219:POKE7680+I,I:POKE38400+I,
   0:NEXTI:X=88:Y=80                 :rem 7
200 GETA$:POKE36876,0:IFA$="{UP}"THENY=Y-
   1:GOTO900                         :rem 114
220 IFA$="{DOWN}"THENY=Y+1:GOTO900
                                     :rem 160
230 IFA$="{LEFT}"THENX=X-1:GOTO900:rem 45
240 IFA$="{RIGHT}"THENX=X+1:GOTO900
                                     :rem 172
250 IFA$="D"THENCW%=NOTCW%:POKE36876,220:
   GOSUB500:GOTO300                  :rem 183
260 IFA$="E"THENEW%=NOTEW%:POKE36876,158:
   GOSUB500                          :rem 193
280 IFA$=CHR$(147)THENGOSUB980:SYS319:A$=
   CHR$(19)                          :rem 119
290 IFA$=CHR$(19)THENX=88:Y=80:POKE36876,
   200:GOSUB500                      :rem 120
300 IFA$="S"THENGOSUB550:GOSUB560:POKE251
   ,LEN(N$):SYS675:SYS694:ON-(S=1)GOSUB9
   96:RUN                            :rem 236
310 IFA$="L"THENGOSUB550:GOSUB560:POKE251
   ,LEN(N$):SYS675:SYS712:ON-(S=1)GOSUB9
   96:RUN                            :rem 221
320 IFA$="Q"THENGOSUB550:END         :rem 181
330 IFA$="G"THENA$="X":GOTO410       :rem 199
340 IFA$=CHR$(199)THENA$="Z":GOTO410
                                     :rem 52
350 IFA$="+"THENQ%=Q%+1:POKE36876,160+Q%:
   IFQ%>90THENQ%=90                  :rem 248
360 IFA$="-"THENQ%=Q%-1:POKE36876,250-Q%:
   IFQ%<1THENQ%=1                    :rem 141
370 IFA$="@"THENA$="X":GOTO430       :rem 198
380 IFA$="0"THENA$="Z":GOTO430       :rem 185
390 IFA$="{F2}"THENGOSUB2000:RUN     :rem 58
400 GOTO900                          :rem 102
410 Y=0:G%=1:FORY=0TO152STEP8:FORX=1TO168
   STEP8:IFX=1THENX=0:GOSUB900       :rem 120
420 GOSUB900:NEXTX,Y:G%=0:X=88:Y=80:GOTO2
   00                                :rem 148
430 G%=1:X%=X:FORY=YTOY+Q%:FORX=XTOX+Q%:G
   OSUB900:NEXTX:X=X%:NEXTY:G%=0:GOTO200
                                     :rem 110
500 FORII=1TO50:NEXTII:RETURN        :rem 169
550 PRINT"{CLR}{BLK}":POKE36867,174:POKE3
   6869,240:POKE36876,0:RETURN       :rem 245
560 INPUT"{BLK}NAME:";N$:ON-(N$="")GOTO99
   9:PRINT:INPUT"1-DISK 2-TAPE";S:IFS=0G
   OTO999                            :rem 21
570 POKE157,128:IFS=1THENOPEN15,8,15,"I0"
   :N$="@:"+N$:POKE678,8:RETURN      :rem 47
580 INPUT"TAPE OFF";O:POKE678,1:RETURN
                                     :rem 133
800 K%=PEEK(W%):S%=K%ORP%(C%):POKEW%,S%:R
   ETURN                             :rem 8
805 POKEW%,PEEK(W%)AND(255-P%(C%)):IFK%<>
   PEEK(W%)THENIFA$<>"Z"THENPOKEW%,S%
                                     :rem 223
820 RETURN                           :rem 122
900 W%=(YAND15)+4096+16*(22*INT(Y/16)+INT
   (X/8)):IFW%>7608GOTO200           :rem 66
910 C%=XAND7:GOSUB800:GOSUB805:POKE36876,
   250                               :rem 132
920 IFA$="Z"THENPOKE36876,160:GOSUB805:ON
   -(G%=0)GOTO200:RETURN             :rem 3
930 IFABS(EW%)=1THENA$="Z":POKE36876,220:
   GOSUB805:GOTO200                  :rem 131
950 IFA$="X"ORABS(CW%)=1THENPOKE36876,225
   :GOSUB800:IFG%=1THENRETURN        :rem 149
960 GOTO200                          :rem 106
970 FORI=675TO675+46:READA:S=S+A:POKEI,A:
   NEXT:IFS<>5648 GOTO1500           :rem 173
980 S=0:RESTORE:FORI=1TO47:READA:NEXT:FOR
   I=319TOI+33:READA:S=S+A:POKEI,A:NEXT
                                     :rem 46
990 IFS<>4875 GOTO1500               :rem 213
994 RETURN                           :rem 134
996 INPUT#15,ER%,ER$,TK%,SC%:PRINT:PRINT:
   PRINTER%;ER$,TK%;SC%:IFER%=0THENRETUR
   N                                 :rem 85
999 CLOSE15:END                      :rem 152
1000 DATA169,3,162,8,160,3,32,186,255,165
   ,251,166,51,164,52,32,189,255,96
                                     :rem 76
1010 DATA169,0,133,1,169,16,133,2,162,195
   ,160,29,169,1,32,216,255,96       :rem 68
1020 DATA169,0,162,195,160,29,32,213,255,
   96                                :rem 121
1030 DATA169,0,133,252, 169,16,133,253,16
   2,13,160,0,169,0,145,252,136,208,249
                                     :rem 200
1040 DATA230,253,202,48,6,208,242,160,195
   ,208,238,141,0,29,96              :rem 235
1500 PRINT"{CLR}DATA ERROR"S:STOP:rem 161
2000 HIGH=20:WIDE=22:ROM=2↑15:ADR=36869:O
   PEN4,4:PRINT#4,CHR$(8)            :rem 18
2010 SIZE=((PEEK(36867)AND1)+1)*8:SC=PEEK
   (648)*256:UC=PEEK(ADR)/8AND1:rem 214
2030 CH=(1-UC)*ROM+(PEEK(ADR)AND7)*1024:L
   IM=INT((5+WIDE*8)/6)*6            :rem 70
2040 FORL=0TOHIGH*SIZE-1STEP7:FORC=0TOLIM
   :A=0:X%=C/8:BIT=2↑(7-C+X%*8):FORR=LT
   OR+6                              :rem 117
2050 Y%=R/SIZE:CC=PEEK(SC+X%+Y%*WIDE):MEM
   =CH                               :rem 204
2060 IFR<HIGH*8THENIFPEEK(CC*SIZE+MEM+R-Y
   %*SIZE)ANDBITTHENA=A+2↑(R-L):rem 148
```

```
2065 GETA$:IFA$="{F4}"ORL>154THENPRINT#4,
     CHR$(15):CLOSE4:RETURN          :rem 5
2070 NEXTR:PRINT#4,CHR$(128-(C<WIDE*8)*A)
     ;:NEXTC:PRINT#4:NEXTL:CLOSE4:RETURN
                                     :rem 92
```

Trap 'Em

Article on page 54.

Program 1: Trap 'Em—64 Version

```
100 CLR:GOSUB670:GOSUB 520:GOSUB540:GOSUB
    260:GOSUB460                     :rem 19
110 S1=0:S2=0:GOSUB410:IFFLTHEN100:rem 25
120 PRINT"{CLR}":C=54272             :rem 181
130 R=R+1:IFS1>=100OR(S2>=100ANDNP=2)OR(R
    =11ANDNP=1)THEN560               :rem 25
140 FORA=1104TO1143:POKEA,160:POKEA+C,0:P
    OKEA+880,160:POKEA+880+C,0:NEXT
                                     :rem 253
150 FORA=1144TO1944STEP40:POKEA,160:POKEA
    +C,0:POKEA+39,160:POKEA+39+C,0:NEXT
                                     :rem 67
160 IFB$="Y"THENGOSUB490             :rem 178
170 IFNP=2THENPRINT"{HOME}{7 SPACES}{RVS}
    {RED}RED"S1"{OFF}{13 SPACES}{RVS}
    {BLU}BLUE"S2                     :rem 136
180 IFNP=1THENPRINT"{HOME}"TAB(8)"{RVS}
    {RED}SCORE"S2;SPC(8)"ROUND"R :rem 226
190 POKE251,194:POKE252,5:POKE253,214:POK
    E254,5:POKE837,7:POKE838,11  :rem 193
200 TI$="000000":SYS49152:SC=INT(TI/60):I
    FNP=1THENSC=SC*LV                :rem 230
210 ONPEEK(834)GOTO220,230           :rem 211
220 SP=PEEK(870)+256*PEEK(871):GOSUB245:S
    2=S2+SC:GOTO120                  :rem 46
230 SP=PEEK(872)+256*PEEK(873):GOSUB245:S
    1=S1+SC:GOTO120                  :rem 49
245 FORA=1TO6:POKESP,PEEK(SP)-2*(PEEK(SP)
    AND128)+128:FORB=1TO400:NEXT    :rem 3
250 NEXT:RETURN                      :rem 240
260 REM OPTION ROUTINE               :rem 123
270 POKE53281,1:PRINT"{CLR}{5 DOWN}"TAB(1
    5)"{RED}TRAP 'EM":POKE198,0      :rem 96
280 PRINT"{3 DOWN}"TAB(13)"{BLU}{RVS}1
    {OFF} ONE PLAYER":PRINT"{2 DOWN}"TAB(
    13)"{RVS}2{OFF} TWO PLAYER"  :rem 171
290 PRINTSPC(13)"{2 DOWN}{RVS}3{OFF} QUIT
    "                                :rem 67
300 GETA$:IFA$<"1"ORA$>"3"THEN300 :rem 52
310 IFA$="3"THENPRINT"{CLR}":END :rem 224
320 NP=VAL(A$):POKE836,NP:PRINT"{3 DOWN}
    {BLK}"TAB(14)"{RVS}J{OFF}OYSTICK OR"
                                     :rem 49
330 PRINT"{DOWN}"TAB(8)"{RVS}K{OFF}EYBOAR
    D AND JOYSTICK 2"            :rem 134
340 GETA$:IFA$="J"THENRETURN         :rem 228
350 IFA$<>"K"THEN340                 :rem 91
360 PRINT"{CLR}{3 DOWN}{7 SPACES}WHICH KE
    Y TO GO UP?":WAIT198,1:A(1)=PEEK(197)
    :POKE198,0                       :rem 207
370 PRINT"{DOWN}{7 SPACES}WHICH KEY TO GO
     DOWN?":WAIT198,1:A(2)=PEEK(197):POKE
    198,0                            :rem 175
380 PRINT"{DOWN}{7 SPACES}WHICH KEY TO GO
     LEFT?":WAIT198,1:A(3)=PEEK(197):POKE
    198,0                            :rem 164
390 PRINT"{DOWN}{7 SPACES}WHICH KEY TO GO
     RIGHT?":WAIT198,1:A(4)=PEEK(197):POK
    E198,0                           :rem 249
400 FORA=1TO4:POKE829+A,A(A):NEXT:RETURN
                                     :rem 11
410 PRINT"{CLR}{5 DOWN}"SPC(11)"ENTER SPE
    ED (0-9)"                        :rem 1
420 PRINTSPC(7)"{2 DOWN}OR (C) TO CHANGE
    {SPACE}OPTIONS"              :rem 161
430 GETA$:IF(A$<"0"ORA$>"9")ANDA$<>"C"THE
    N430                             :rem 203
440 IFA$="C"THENFL=1                 :rem 127
450 LV=VAL(A$):P=60-LV*6:POKE839,P:POKE84
    0,P:LV=LV+1:RETURN           :rem 168
460 PRINT"{CLR}"SPC(8)"{4 DOWN}DO YOU WAN
    T BARRIERS?"                     :rem 88
470 GETB$:IFB$<>"Y"ANDB$<>"N"THEN470
                                     :rem 54
480 RETURN                           :rem 124
490 FORA=1TO30                       :rem 57
500 Q=RND(1)*870+1104:IFPEEK(Q)<>32OR(Q>1
    463ANDQ<1503)THEN500         :rem 238
510 POKEQ,160:POKEQ+C,0:NEXT:RETURN
                                     :rem 240
520 REM INITIALIZE                   :rem 109
530 FORA=54272TO54296:POKEA,0:NEXT:RETURN
                                     :rem 71
540 POKE54287,255:POKE54290,129:POKE54273
    ,7:POKE54296,15:POKE54277,21 :rem 166
550 POKE54278,240:RETURN             :rem 175
560 GOSUB520:IFNP=2THEN600           :rem 77
570 PRINT"{CLR}{10 DOWN}"SPC(15)"{BLU}SCO
    RE:"S2                           :rem 229
580 IFS2>HITHENHI=S2                  :rem 2
590 PRINTSPC(16)"{DOWN}{RED}HIGH:"HI:GOTO
    640                              :rem 50
600 W=-(S1>=100)-2*(S2>=100):PRINT"{CLR}
    {6 DOWN}"SPC(13)"{RED}PLAYER"W"WINS!"
                                     :rem 108
610 PRINT"{2 DOWN}{BLU}{4 SPACES}PLAYER1:
    "S1:PRINTSPC(25)"{UP}PLAYER2:"S2
                                     :rem 93
620 WI(W)=WI(W)+1:PRINT"{2 DOWN}
    {4 SPACES}WINS{3 SPACES}:"WI(1):PRINT
    SPC(25)"{UP}WINS{3 SPACES}:"WI(2)
                                     :rem 99
630 T1=T1+S1:T2=T2+S2:PRINT"{2 DOWN}
    {4 SPACES}TOTAL{2 SPACES}:"T1:PRINTSP
    C(25)"{UP}TOTAL{2 SPACES}:"T2:rem 176
640 PRINTSPC(15)"{2 DOWN}HIT ANY KEY":POK
    E198,0                           :rem 71
650 GETA$:IFA$=""THEN650             :rem 89
660 ONNPGOTO100,110                  :rem 95
670 I=49152:IFPEEK(I)=32THENRETURN:rem 97
680 PRINT"{CLR}{5 DOWN}"SPC(13)"PLEASE WA
    IT"                              :rem 37
690 READ A:IF A=256 THEN RETURN  :rem 239
700 POKE I,A:I=I+1:GOTO 690          :rem 243
710 DATA 32,22,192,32,229,192        :rem 145
720 DATA 173,66,3,240,1,96           :rem 255
730 DATA 32,72,193,165,197,208       :rem 210
740 DATA 237,76,15,192,169,33        :rem 162
750 DATA 141,4,212,162,3,181          :rem 87
760 DATA 251,157,102,3,202,16        :rem 137
770 DATA 248,160,100,173,0,220       :rem 185
780 DATA 41,15,201,15,208,3           :rem 38
790 DATA 173,70,3,141,61,3           :rem 251
800 DATA 141,70,3,173,1,220           :rem 30
810 DATA 141,60,3,165,197,205        :rem 146
820 DATA 62,3,208,4,162,254           :rem 45
830 DATA 208,33,205,63,3,208          :rem 94
840 DATA 4,162,253,208,24,205        :rem 144
```

```
850 DATA 64,3,208,4,162,251          :rem 47
860 DATA 208,15,205,65,3,208         :rem 99
870 DATA 4,162,247,208,6,173        :rem 106
880 DATA 60,3,76,111,192,138        :rem 103
890 DATA 45,60,3,41,15,201          :rem 247
900 DATA 15,208,3,173,69,3          :rem 255
910 DATA 141,60,3,141,69,3          :rem 247
920 DATA 136,208,166,169,32,141     :rem 253
930 DATA 4,212,206,71,3,208          :rem 40
940 DATA 154,173,72,3,141,71         :rem 98
950 DATA 3,160,0,162,0,185          :rem 245
960 DATA 60,3,74,176,8,169           :rem 15
970 DATA 40,32,199,192,76,190       :rem 165
980 DATA 192,74,176,8,169,40        :rem 120
990 DATA 32,217,192,76,190,192      :rem 214
1000 DATA 74,176,8,169,1,32          :rem 46
1010 DATA 199,192,76,190,192,169     :rem 58
1020 DATA 1,32,217,192,232,232      :rem 179
1030 DATA 200,204,68,3,208,207      :rem 182
1040 DATA 96,141,67,3,181,251       :rem 146
1050 DATA 56,237,67,3,149,251       :rem 153
1060 DATA 181,252,233,0,149,252     :rem 239
1070 DATA 96,24,117,251,149,251     :rem 250
1080 DATA 181,252,105,0,149,252     :rem 239
1090 DATA 96,160,0,173,68,3          :rem 50
1100 DATA 201,1,240,35,165,251      :rem 174
1110 DATA 197,253,208,29,165,252     :rem 46
1120 DATA 197,254,208,23,173,27     :rem 249
1130 DATA 212,16,9,169,1,141         :rem 87
1140 DATA 66,3,32,83,193,96          :rem 55
1150 DATA 169,2,141,66,3,32          :rem 41
1160 DATA 105,193,96,160,0,140      :rem 188
1170 DATA 66,3,173,27,212,16          :rem 94
1180 DATA 7,32,41,193,32,53           :rem 43
1190 DATA 193,96,32,53,193,32        :rem 156
1200 DATA 41,193,96,177,251,201      :rem 244
1210 DATA 32,240,5,169,1,141          :rem 81
1220 DATA 66,3,96,173,68,3             :rem 5
1230 DATA 201,1,240,11,177,253       :rem 177
1240 DATA 201,32,240,5,169,2          :rem 82
1250 DATA 141,66,3,96,32,105          :rem 93
1260 DATA 193,173,68,3,201,2          :rem 93
1270 DATA 240,1,96,169,219,145       :rem 204
1280 DATA 253,165,253,24,105,0       :rem 189
1290 DATA 133,106,165,254,105,212    :rem 82
1300 DATA 133,107,169,6,145,106      :rem 240
1310 DATA 96,160,0,169,214,145       :rem 194
1320 DATA 251,165,251,24,105,0       :rem 180
1330 DATA 133,106,165,252,105,212    :rem 75
1340 DATA 133,107,169,2,145,106      :rem 240
1350 DATA 96,256                      :rem 27
```

Program 2: Trap 'Em—VIC Loader

```
100 I=7168:PRINT"{CLR}{5 DOWN}{5 SPACES}P
    LEASE WAIT"                      :rem 207
110 READ A:IF A=256 THEN 130         :rem 150
120 POKE I,A:I=I+1:GOTO 110          :rem 226
130 S$="LO"+CHR$(34)+"VT"+CHR$(34)+",8:"+
    CHR$(131)                        :rem 167
140 REM CHANGE 8 TO 1 FOR TAPE USERS
                                     :rem 206
150 FORI=1TOLEN(S$):POKE630+I,ASC(MID$(S$
    ,I)):NEXT:POKE198,I              :rem 124
160 DATA 32,22,28,32,10,29           :rem 241
170 DATA 173,66,3,240,1,96           :rem 254
180 DATA 32,109,29,165,197,208       :rem 208
190 DATA 237,76,15,28,169,130        :rem 157
200 DATA 141,11,144,162,3,181        :rem 127
210 DATA 251,157,102,3,202,16        :rem 127
220 DATA 248,160,100,169,127,141      :rem 32
230 DATA 34,145,173,32,145,41        :rem 139
240 DATA 128,74,74,74,74,141         :rem 105
250 DATA 67,3,169,255,141,34         :rem 102
260 DATA 145,173,17,145,74,74        :rem 155
270 DATA 41,7,13,67,3,41             :rem 148
280 DATA 15,201,15,208,3,173          :rem 87
290 DATA 70,3,141,61,3,141           :rem 241
300 DATA 70,3,169,255,141,60          :rem 91
310 DATA 3,165,197,205,62,3           :rem 44
320 DATA 208,4,162,254,208,33        :rem 141
330 DATA 205,63,3,208,4,162           :rem 38
340 DATA 253,208,24,205,64,3          :rem 91
350 DATA 208,4,162,251,208,15        :rem 141
360 DATA 205,65,3,208,4,162           :rem 43
370 DATA 247,208,6,173,60,3           :rem 49
380 DATA 76,139,28,138,45,60         :rem 112
390 DATA 3,41,15,201,15,208           :rem 35
400 DATA 3,173,69,3,141,60           :rem 246
410 DATA 3,141,69,3,136,208           :rem 42
420 DATA 138,140,11,144,206,71       :rem 184
430 DATA 3,208,128,173,72,3           :rem 44
440 DATA 141,71,3,160,0,162           :rem 31
450 DATA 0,173,75,3,240,6            :rem 197
460 DATA 173,61,3,141,60,3           :rem 244
470 DATA 185,60,3,74,176,8             :rem 9
480 DATA 169,22,32,236,28,76         :rem 109
490 DATA 227,28,74,176,8,169         :rem 121
500 DATA 22,32,254,28,76,227          :rem 97
510 DATA 28,74,176,8,169,1             :rem 8
520 DATA 32,236,28,76,227,28         :rem 105
530 DATA 169,1,32,254,28,232          :rem 96
540 DATA 232,200,204,68,3,208        :rem 137
550 DATA 207,96,141,67,3,181         :rem 104
560 DATA 251,56,237,67,3,149         :rem 110
570 DATA 251,181,252,233,0,149       :rem 195
580 DATA 252,96,24,117,251,149       :rem 208
590 DATA 251,181,252,105,0,149       :rem 195
600 DATA 252,96,160,0,173,68         :rem 100
610 DATA 3,201,1,240,35,165           :rem 30
620 DATA 251,197,253,208,29,165        :rem 2
630 DATA 252,197,254,208,23,32       :rem 200
640 DATA 166,29,16,9,169,1             :rem 9
650 DATA 141,66,3,32,120,29           :rem 41
660 DATA 96,169,2,141,66,3             :rem 8
670 DATA 32,142,29,96,160,0           :rem 48
680 DATA 140,66,3,32,166,29           :rem 53
690 DATA 16,7,32,78,29,32            :rem 215
700 DATA 90,29,96,32,90,29             :rem 9
710 DATA 32,78,29,96,177,251         :rem 115
720 DATA 201,32,240,5,169,1           :rem 35
730 DATA 141,66,3,96,173,68           :rem 61
740 DATA 3,201,1,240,11,177           :rem 31
750 DATA 253,201,32,240,5,169        :rem 143
760 DATA 2,141,66,3,96,32            :rem 206
770 DATA 142,29,173,68,3,201         :rem 101
780 DATA 2,240,1,96,169,219           :rem 57
790 DATA 145,253,165,253,24,105      :rem 252
800 DATA 0,133,106,165,254,105       :rem 185
810 DATA 120,133,107,169,6,145       :rem 193
820 DATA 106,96,160,0,169,214        :rem 148
830 DATA 145,251,165,251,24,105      :rem 243
840 DATA 0,133,106,165,252,105       :rem 187
850 DATA 120,133,107,169,2,145       :rem 193
860 DATA 106,96,173,74,3,10           :rem 52
870 DATA 10,56,109,74,3,141           :rem 47
880 DATA 74,3,96,256                 :rem 232
```

Program 3:
Trap 'Em—VIC Main Game

```
100 POKE52,28:POKE56,28:CLR:POKE36878,15:
```

```
    GOSUB270:GOSUB480                :rem 246
110 S1=0:S2=0:GOSUB430:IFFLTHEN100:rem 27
120 PRINT"{CLR}":C=30720             :rem 173
130 R=R+1:IFS1>=100OR(S2>=100ANDNP=2)OR(R
    =11ANDNP=1)THEN540               :rem 23
140 FORA=7724TO7745:POKEA,160:POKEA+C,0:P
    OKEA+440,160:POKEA+440+C,0:NEXT:rem 9
150 FORA=7746TO8142STEP22:POKEA,160:POKEA
    +C,0:POKEA+21,160:POKEA+21+C,0:NEXT
                                     :rem 60
160 IFB$="Y"THENGOSUB510             :rem 171
170 IFNP=2THENPRINT"{HOME}{RVS}{RED}RED"S
    1"{OFF}{7 SPACES}{RVS}{BLU}BLUE"S2
                                     :rem 136
180 IFNP=1THENPRINT"{HOME}{RVS}{RED}SCORE
    "S2"{HOME}"SPC(12)"ROUND"R       :rem 133
190 POKE251,225:POKE252,30:POKE253,235:PO
    KE254,30:POKE837,7:POKE838,D1    :rem 46
200 TI$="000000":SYS7168:SC=INT(TI/60):IF
    NP=1THENSC=SC*LV                 :rem 183
210 ONPEEK(834)GOTO220,230           :rem 211
220 SP=PEEK(870)+256*PEEK(871):GOSUB240:S
    2=S2+SC:GOTO120                  :rem 41
230 SP=PEEK(872)+256*PEEK(873):GOSUB240:S
    1=S1+SC:GOTO120                  :rem 44
240 POKE36877,130:FORA=1TO6          :rem 61
250 POKESP,PEEK(SP)-2*(PEEK(SP)AND128)+12
    8:FORB=1TO400:NEXT:POKE36878,6-A:NEXT
                                     :rem 24
260 POKE36877,0:POKE36878,15:RETURN
                                     :rem 87
270 REM OPTION ROUTINE               :rem 124
280 POKE36879,25:PRINT"{CLR}{5 DOWN}"TAB(
    7)"{RED}TRAP 'EM":POKE198,0      :rem 118
290 PRINT"{3 DOWN}"TAB(5)"{BLU}{RVS}1
    {OFF} ONE PLAYER":PRINT"{2 DOWN}"TAB(
    5)"{RVS}2{OFF} TWO PLAYER"       :rem 78
300 PRINTSPC(5)"{2 DOWN}{RVS}3{OFF} QUIT"
                                     :rem 12
310 GETA$:IFA$<"1"ORA$>"3"THEN310    :rem 54
320 IFA$="3"THENPRINT"{CLR}":END     :rem 225
330 NP=VAL(A$):POKE836,NP            :rem 222
340 D1=11:POKE843,0:IFNP=2THEN380:rem 175
350 PRINT"{2 DOWN} {RVS}J{OFF}OYSTICK OR
    {SPACE}{RVS}K{OFF}EYBOARD"       :rem 53
360 GETA$:IFA$="J"THENPOKE843,1:D1=7:RETU
    RN                               :rem 110
370 IFA$<>"K"THEN360                 :rem 95
380 PRINT"{CLR}{3 DOWN}WHICH KEY TO GO UP
    ":WAIT198,1:A(1)=PEEK(197):POKE198,0
                                     :rem 146
390 PRINT"{DOWN}WHICH KEY TO GO DOWN":WAI
    T198,1:A(2)=PEEK(197):POKE198,0
                                     :rem 114
400 PRINT"{DOWN}WHICH KEY TO GO LEFT":WAI
    T198,1:A(3)=PEEK(197):POKE198,0
                                     :rem 94
410 PRINT"{DOWN}WHICH KEY TO GO RIGHT":WA
    IT198,1:A(4)=PEEK(197):POKE198,0
                                     :rem 179
420 FORA=1TO4:POKE829+A,A(A):NEXT:RETURN
                                     :rem 13
430 PRINT"{CLR}{5 DOWN}{3 SPACES}ENTER SP
    EED (0-9)"                       :rem 38
440 PRINT"{2 DOWN}{2 SPACES}OR (C) FOR OP
    TIONS"                           :rem 211
450 GETA$:IF(A$<"0"ORA$>"9")ANDA$<>"C"THE
    N450                             :rem 207
460 IFA$="C"THENFL=1                 :rem 129
470 LV=VAL(A$):P=60-LV*6:POKE839,P:POKE84
    0,P:LV=LV+1:RETURN               :rem 170
480 PRINT"{CLR}{4 DOWN}DO YOU WANT BARRIE
    RS?"                             :rem 167
490 GETB$:IFB$<>"Y"ANDB$<>"N"THEN490
                                     :rem 58
500 RETURN                           :rem 117
510 FORA=1TO15                       :rem 53
520 Q=RND(1)*430+7746:IFPEEK(Q)<>32OR(Q>7
    899ANDQ<7922)THEN520             :rem 26
530 POKEQ,160:POKEQ+C,0:NEXT:RETURN
                                     :rem 242
540 IFNP=2THEN580                    :rem 1
550 PRINT"{CLR}{8 DOWN}"SPC(7)"{BLU}SCORE
    :"S2                             :rem 146
560 IFS2>HITHENHI=S2                 :rem 0
570 PRINTSPC(8)"{DOWN}{RED}HIGH:"HI:GOTO6
    20                               :rem 255
580 W=-(S1>=100)-2*(S2>=100):PRINT"{CLR}
    {5 DOWN}"SPC(5)"{RED}PLAYER"W"WINS!"
                                     :rem 51
590 PRINT"{2 DOWN}{BLU}SC{2 SPACES}:"S1:P
    RINTSPC(12)"{UP}SC{2 SPACES}:"S2
                                     :rem 143
600 WI(W)=WI(W)+1:PRINT"{2 DOWN}WINS:"WI(
    1):PRINTSPC(12)"{UP}WINS:"WI(2)
                                     :rem 93
610 T1=T1+S1:T2=T2+S2:PRINT"{2 DOWN}TOT :
    "T1:PRINTSPC(12)"{UP}TOT :"T2:rem 144
620 PRINTSPC(6)"{2 DOWN}HIT ANY KEY":POKE
    198,0                            :rem 21
630 GETA$:IFA$=""THEN630             :rem 85
640 ONNPGOTO100,110                  :rem 93
```

Magazine Indexer

Article on page 66.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 SYS65517:Z=PEEK(781):IFZ=40THENPOKE53
    281,0:I$="":V=10:R$="":DIMAR$(500)
                                     :rem 56
110 IFZ=22THENPOKE36879,14:I$="{2 DOWN}":
    V=5:R$="{5 RIGHT}":Q$=CHR$(13):DIMAR$
    (50)                             :rem 77
120 DIM H$(7),B(3),T(3),MG$(3):BL$="
    {16 SPACES}"                     :rem 44
130 B(0)=1:B(1)=11:B(2)=16:B(3)=31:T(0)=1
    0:T(1)=5:T(2)=15:T(3)=1          :rem 9
140 J$="ARTICLES BY "                :rem 118
150 H$(0)="{RVS}{YEL}MAGAZINE{OFF}{WHT}":
    H$(1)="{RVS}{CYN}DATE{OFF}{WHT}"
                                     :rem 166
160 H$(2)="{RVS}{PUR}TITLE{OFF}{WHT}":H$(
    3)="{RVS}{RED}CATEGORY{OFF}{WHT}"
                                     :rem 156
170 H$(4)="TITLE OF {RVS}{YEL}MAGAZINE
    {OFF}":H$(5)="ISSUE DATE {RVS}{CYN}(M
    M/YY){OFF}"                      :rem 18
180 H$(6)="TITLE OF {RVS}{PUR}ARTICLE
    {OFF}":H$(7)="ARTICLE {RVS}{RED}CATEG
    ORY{OFF}"                        :rem 57
190 PRINT"{CLR}{DOWN}{3 RIGHT}{WHT}{RVS}
    {CYN}MAGAZINE{OFF} {RVS}INDEXER{WHT}
    {OFF}{2 DOWN}"                   :rem 212
```

```
200 PRINT"1. LOAD ALL ARTICLES":PRINT"2.
    {SPACE}LIST ALL ARTICLES"     :rem 233
210 PRINT"3. ENTER NEW ARTICLES":PRINT"4.
     DELETE PREVIOUS "R$"ENTRIES":rem 245
220 PRINT"5. LIST "J$R$H$(0):PRINT"6. LIS
    T "J$R$H$(1)                  :rem 82
230 PRINT"7. LIST "J$R$H$(2):PRINT"8. LIS
    T "J$R$H$(3)                  :rem 91
240 PRINT"9. SAVE DATA AND END"   :rem 193
250 PRINT"{DOWN}{3 RIGHT}{RVS}SELECT CHOI
    CE{OFF} ";                    :rem 26
260 GETC$:C=VAL(C$):IFC<1ORC>9THEN260
                                  :rem 207
270 PRINTC$:FORI=1TO750:NEXT      :rem 29
280 ONCGOTO700,420,290,640,510,510,510,51
    0,700                         :rem 100
290 N=N+1                         :rem 208
300 PRINT"{CLR}";TAB(5)"{RVS}NEW ENTRIES
    {DOWN}":PRINTTAB(5)"RECORD #"N
                                  :rem 146
310 FORK=0TO3:PRINT"{DOWN}"H$(K+4);
                                  :rem 199
320 FORJ=1TOT(K)+3:PRINT"{RVS}{WHT} ";:NE
    XT:FORJ=1TOT(K)+3:PRINT"{LEFT}";:NEXT
    :INPUTMG$(K)                  :rem 63
330 IFK=1ANDMID$(MG$(K),3,1)<>"/"THENMG$(
    K)="0"+MG$(K)                 :rem 176
340 MG$(K)=LEFT$(MG$(K),T(K)):MG$(K)=MG$(
    K)+LEFT$(BL$,T(K)-LEN(MG$(K))):NEXTK
                                  :rem 101
350 AR$(N)=MG$(0)+MG$(1)+MG$(2)+MG$(3)
                                  :rem 150
360 FORK=0TO3:MG$(K)="":NEXT      :rem 150
370 PRINT"{5 DOWN}PRESS {RVS}RETURN{OFF}
    {SPACE}FOR ADD'L ENTRIES":GOSUB910
                                  :rem 98
380 GETC$:IFC$=""THEN380          :rem 93
390 IFC$=CHR$(13)THEN290          :rem 79
400 IFC$="{F1}"THEN190            :rem 89
410 C$="":GOTO380                 :rem 139
420 IFN=0THENPRINT"{DOWN}{RVS}{YEL}NO ART
    ICLES ON FILE.":FORJ=1TO1500:NEXT:GOT
    O190                          :rem 72
430 I=1                           :rem 78
440 LC=0:HD$="{RVS}LIST 'ARTICLES' FILE
    {OFF}":GOSUB850               :rem 251
450 LC=LC+1:GOSUB870:GOSUB880:I=I+1:IFI<=
    NANDLC<>VTHEN450              :rem 59
460 GOSUB900                      :rem 179
470 GETCH$:IFCH$=""THEN470        :rem 237
480 IFCH$="{F1}"ORI>NTHEN190      :rem 31
490 IFCH$=CHR$(13)THEN440         :rem 149
500 GOTO470                       :rem 105
510 PRINT"{DOWN}{WHT}"TAB(2)H$(C-1):C=C-5
                                  :rem 148
520 FORJ=1TOT(C)+3:PRINT"{RVS}{WHT} ";:NE
    XT:FORJ=1TOT(C)+3:PRINT"{LEFT}";:NEXT
    :INPUTMH$                     :rem 150
530 IFC=1ANDMID$(MH$,3,1)<>"/"THENMH$="0"
    +MH$                          :rem 217
540 MH$=LEFT$(MH$,T(C)):MH$=MH$+LEFT$(BL$
    ,T(C)-LEN(MH$))               :rem 140
550 I=1                           :rem 81
560 LC=0:HD$=J$+H$(C):GOSUB850    :rem 174
570 GOSUB870:IFMH$=MG$(C)THENGOSUB880:LC=
    LC+1                          :rem 6
580 I=I+1:IFI<=NANDLC<>VTHEN570   :rem 158
590 GOSUB900                      :rem 183
600 GETC$:IFC$=""THEN600          :rem 83
610 IFC$="{F1}"ORI>NTHEN190       :rem 210
620 IFC$=CHR$(13)THEN560          :rem 75
630 GOTO600                       :rem 104
640 PRINT"{DOWN}{WHT}{2 RIGHT}DELETE REC
    {SPACE}#";                    :rem 166
650 INPUT" {RVS}{WHT}{3 SPACES}{3 LEFT}
    {CYN}";A$:IFA$=""THEN650      :rem 21
660 I=VAL(A$):IFI>NTHENPRINT"{RVS}{YEL}RE
    CORD NOT ON FILE.";:GOTO690   :rem 241
670 AR$(I)="":PRINT"{2 RIGHT}{RVS}{YEL}RE
    CORD DELETED.";               :rem 131
680 N=N-1:FORJ=ITON:AR$(J)=AR$(J+1):NEXT
                                  :rem 167
690 FORI=1TO1000:NEXT:GOTO190     :rem 39
700 PRINT"{CLR}DISK OR CASSETTE (D/C)"
                                  :rem 42
710 GETE$:IF(E$<>"D"ANDE$<>"C")ORE$=""THE
    N710                          :rem 245
720 IFE$="D"THENF$="@0:ARTICLES":D1=1:GOT
    O740                          :rem 156
730 F$="ARTICLES":D1=0:G$=""      :rem 30
740 IFC=9THEN780                  :rem 177
750 IFD1=1THENG$=",S,R"           :rem 38
760 OPEN1,1+7*D1,8*D1,F$+G$:GOSUB810
                                  :rem 224
770 INPUT#1,N:FORI=1TON:INPUT#1,AR$(I):NE
    XT:GOSUB810:CLOSE1:GOSUB810:GOTO190
                                  :rem 109
780 IFD1=1THENG$=",S,W"           :rem 46
790 OPEN1,1+7*D1,1+7*D1,F$+G$:GOSUB810
                                  :rem 62
800 PRINT#1,N:FORI=1TON:PRINT#1,AR$(I):NE
    XT:GOSUB810:CLOSE1:GOSUB810:END
                                  :rem 101
810 IFD1=0THENRETURN              :rem 25
820 IFO=0THENOPEN15,8,15:O=1      :rem 153
830 INPUT#15,A,B$,C,D:IFATHENPRINTA,B$,C,
    D:STOP                        :rem 138
840 RETURN                        :rem 124
850 PRINT"{CLR}{WHT}"HD$:PRINT:PRINT"
    {RVS}REC#{OFF}{2 SPACES}{RVS}MAGAZINE
    {OFF}{3 SPACES}";             :rem 84
860 PRINTQ$"{RVS}DATE{OFF}{2 SPACES}{RVS}
    ARTICLE TITLE{DOWN}":RETURN   :rem 105
870 FORK=0TO3:MG$(K)=MID$(AR$(I),B(K),T(K
    )):NEXT:RETURN                :rem 56
880 X0=LEN(STR$(I)):X1$=LEFT$("***",4-X0)
    +RIGHT$(STR$(I),X0-1)         :rem 206
890 PRINT" "X1$"{2 SPACES}"MG$(0)" "Q$MG$
    (1)" "MG$(2)" ":RETURN        :rem 108
900 IFI<=NTHENPRINT"{DOWN}{WHT}PRESS
    {RVS}RETURN{OFF} TO CONT'"    :rem 93
910 PRINT"{WHT}PRESS {RVS}F1{OFF} FOR MEN
    U";:RETURN                    :rem 137
```

Baker's Dozen

Article on page 133.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Quilt

```
10 PRINTCHR$(147)CHR$(5):POKE53280,0:POKE
   53281,0                        :rem 242
20 R=54272:A=1                    :rem 222
```

```
30 N=INT(10*RND(1))+1:P=INT(10*RND(1))+1:
   Q=INT(15*RND(1))+1                :rem 29
40 V=INT(1000*RND(1))+1024:M=INT(255*RND(
   1))+1                             :rem 254
50 IFV+N>2023THENV=V-N:GOTO40        :rem 50
60 IFV+(40*P)>2023THENV=V-(V0*P):GOTO40
                                     :rem 23
70 FORZ=1TOP                         :rem 9
80 FORX=1TON:POKEV+A,M:POKEV+A+R,Q:V=V+A:
   NEXT                              :rem 215
90 V=V+40-N                          :rem 92
100 NEXTZ:GOTO30                     :rem 0
```

Program 2: Double Diamond

```
10 PRINTCHR$(147):FORX=1TO500:NEXT
                                     :rem 116
20 POKE53280,0:POKE53281,0           :rem 183
30 V=1475:A=-39:B=-41:C=39:D=41:W=1491:Q=
   INT(255*RND(1))+1:PRINTQ:S=55753
                                     :rem 189
40 U=55757                           :rem 3
50 T=INT(15*RND(1))+1                :rem 132
60 POKEV,Q:POKES,T:PRINTT            :rem 191
70 N=1:FORX=1TON:POKEV+A,Q:POKES+A,T:V=V+
   A:S=S+A:NEXT                      :rem 220
80 FORX=1TON:POKEV+B,Q:POKES+B,T:V=V+B:S=
   S+B:NEXT                          :rem 235
90 N=N+1:FORX=1TON:POKEV+C,Q:POKES+C,T:V=
   V+C:S=S+C:NEXT                    :rem 95
100 FORX=1TON:POKEV+D,Q:POKES+D,T:V=V+D:S
    =S+D:NEXT                        :rem 28
110 N=N+1:FORX=1TON:POKEV+A,Q:POKES+A,T:V
    =V+A:S=S+A:NEXT                  :rem 128
120 FORX=1TON:POKEV+B,Q:POKES+B,T:V=V+B:S
    =S+B:NEXT                        :rem 22
130 IFV>1042THEN90                   :rem 22
140 POKEW,Q:POKEU,T                  :rem 214
150 N=1:FORX=1TON:POKEW+A,Q:POKEU+A,T:W=W
    +A:U=U+A:NEXT                    :rem 20
160 FORX=1TON:POKEW+B,Q:POKEU+B,T:W=W+B:U
    =U+B:NEXT                        :rem 35
170 N=N+1:FORX=1TON:POKEW+C,Q:POKEU+C,T:W
    =W+C:U=U+C:NEXT                  :rem 151
180 FORX=1TON:POKEW+D,Q:POKEU+D,T:W=W+D:U
    =U+D:NEXT                        :rem 45
190 N=N+1:FORX=1TON:POKEW+A,Q:POKEU+A,T:W
    =W+A:U=U+A:NEXT                  :rem 145
200 FORX=1TON:POKEW+B,Q:POKEU+B,T:W=W+B:U
    =U+B:NEXT                        :rem 30
210 IFW>1042THEN170                  :rem 69
220 FORX=1TO1000:NEXT                :rem 30
230 GOTO10                           :rem 47
```

Program 3: Tunnels

```
10 POKE53280,0:POKE53281,0:PRINTCHR$(147)
                                     :rem 107
20 A=1:B=-1:C=40:D=-40:N=1:P=54272:V=1984
                                     :rem 246
30 FORZ=1TO12:GOSUB110               :rem 100
40 V=V-39:N=N+1                      :rem 85
50 NEXT                              :rem 164
60 V=V+42:N=N-1                      :rem 81
70 FORZ=1TO12:GOSUB110               :rem 104
80 V=V+42:N=N-1                      :rem 83
90 NEXT                              :rem 168
100 END                              :rem 104
110 Q=INT(15*RND(1))+1               :rem 174
120 FORX=1TON:POKEV+A,67:POKEV+A+P,Q:V=V+
    A:NEXT                           :rem 32
130 POKEV,75:POKEV+P,Q               :rem 104
140 FORX=1TON:POKEV+D,66:POKEV+D+P,Q:V=V+
    D:NEXT                           :rem 42
150 POKEV,73:POKEV+P,Q               :rem 104
160 FORX=1TON:POKEV+B,67:POKEV+B+P,Q:V=V+
    B:NEXT                           :rem 39
170 POKEV,85:POKEV+P,Q               :rem 109
180 FORX=1TON:POKEV+C,66:POKEV+C+P,Q:V=V+
    C:NEXT                           :rem 43
190 POKEV,74:POKEV+P,Q               :rem 109
200 RETURN                           :rem 114
```

Program 4: Christmas Tree

```
10 PRINTCHR$(147):POKE53280,0:POKE53281,0
                                     :rem 107
20 FORX=1TO1000:NEXT                 :rem 236
30 PRINTCHR$(147)                    :rem 222
40 DIMP(156)                         :rem 123
50 FORK=1TO156:READP(K):NEXT         :rem 255
60 K=INT(156*RND(1))+1               :rem 178
70 B=P(K)+54272                      :rem 1
80 C=INT(14*RND(1))+1                :rem 117
90 POKEP(K),42:POKEB,C               :rem 48
100 GOTO60                           :rem 48
110 DATA1042,1082,1122,1161,1162,1163
                                     :rem 62
120 DATA1201,1202,1203,1241,1242,1243
                                     :rem 51
130 DATA1280,1281,1282,1283,1284,1320
                                     :rem 81
140 DATA1320,1321,1322,1323,1324,1360
                                     :rem 61
150 DATA1361,1362,1363,1364,1399,1400
                                     :rem 89
160 DATA1401,1402,1403,1404,1405,1439
                                     :rem 70
170 DATA1440,1441,1442,1443,1444,1445
                                     :rem 83
180 DATA1479,1480,1481,1482,1483,1484
                                     :rem 111
190 DATA1485,1518,1519,1520,1521,1522
                                     :rem 92
200 DATA1523,1524,1525,1526,1558,1559
                                     :rem 97
210 DATA1560,1561,1562,1563,1564,1565
                                     :rem 96
220 DATA1566,1598,1599,1600,1601,1602
                                     :rem 99
230 DATA1603,1604,1605,1606,1637,1638
                                     :rem 92
240 DATA1639,1640,1641,1642,1643,1644
                                     :rem 96
250 DATA1645,1646,1647,1677,1678,1679
                                     :rem 130
260 DATA1680,1681,1682,1683,1684,1685
                                     :rem 119
270 DATA1686,1687,1717,1718,1719,1720
                                     :rem 119
280 DATA1721,1722,1723,1724,1725,1726
                                     :rem 97
290 DATA1727,1756,1757,1758,1759,1760
                                     :rem 130
300 DATA1761,1762,1763,1764,1765,1766
                                     :rem 114
310 DATA1767,1768,1796,1797,1798,1799
                                     :rem 151
320 DATA1800,1801,1802,1803,1804,1805
                                     :rem 80
330 DATA1806,1807,1808,1836,1837,1838
                                     :rem 117
340 DATA1839,1840,1841,1842,1843,1844
                                     :rem 109
```

```
350 DATA1845,1846,1847,1848,1882,1922
                                        :rem 125
360 DATA1962,2000,2001,2002,2003,2004
                                        :rem 53
```

Math Dungeon

Article on page 62.

Note: Requires at least 8K memory expansion to run on a VIC.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
110 DIM CM$(22),CM(22),IN$(5),IN(5),OB$(1
    3),OB(13),DS$(40),FL(10,10)  :rem 157
120 SYS65517:CC=PEEK(781)        :rem 173
130 IFCC=40THENPOKE53281,1         :rem 8
150 GOSUB 700:GOSUB1620           :rem 48
155 PRINT"{CLR}"                 :rem 255
160 GOSUB790:CM(2)=1:CM(5)=1:FORI=14TO19:
    CM(I)=1:NEXT:OB(1)=1          :rem 79
170 PR$=DS$(1):GOSUB2570:IFGTTHENPR$=DS$(
    2):GOSUB2570                  :rem 188
180 IFGT=0THENPR$=DS$(3):GOSUB2570:rem 41
190 GOSUB2310:IFPL=2ORPL=5THENGOSUB800:GO
    TO190                         :rem 183
200 IFPL=16ANDGT=0THENPR$=DS$(3):GOSUB257
    0:GOTO190                     :rem 66
210 IFPL=16THEN280                :rem 43
220 IFPL>16THENGOTO250            :rem 99
230 GOTO170                      :rem 102
240 PRINT"{CLR}":PR$=DS$(4):GOSUB2570
                                 :rem 255
250 GOSUB790:FORI=14TO19:CM(I)=1:NEXT:GOS
    UB2310:IFPL=16THEN280         :rem 109
260 IFPL=15THENPR$=DS$(4):GOSUB2570
                                  :rem 96
270 GOTO250                      :rem 105
280 GOSUB790:PRINT"{CLR}":CM(1)=1:CM(3)=1
    :CM(6)=1:FORI=14TO19:CM(I)=1:NEXT
                                 :rem 241
290 CM(4)=1                       :rem 30
300 PR$=DS$(5):GOSUB2570:IFMB=0THENPR$=DS
    $(6):GOSUB2570                :rem 32
310 IFMBTHENPR$=DS$(7):CM(7)=1:GOSUB2570:
    IFNT=1THENPR$=DS$(11):GOSUB 2570
                                 :rem 112
320 IFFD=0THENPR$=DS$(8):NT=1:GOSUB2570
                                  :rem 99
330 IFFDTHENPR$=DS$(9):NT=0:GOSUB2570
                                 :rem 247
340 GOSUB2310:IFPL=15THEN300     :rem 167
350 IF(PL=18)OR(PL=19)THENGOTO300:rem 234
360 IFPL=17THENGOTO160           :rem 104
370 IF(PL=16)AND(FD=0)THEN320    :rem 153
380 IFPL=16ANDFD=0THEN320        :rem 248
390 IFPL=16THEN450                :rem 51
400 IFPL=1THENPR$=DS$(10):GOSUB2570
                                  :rem 84
410 IF(PL=3)OR(PL=6)THENGOSUB900:GOTO340
                                 :rem 212
415 IFPL=7ANDNT=0THENPRINT"I SEE NO NOTE
    {SPACE}HERE!":GOTO340         :rem 99
420 IFPL<>7THEN340                :rem 56
430 PR$="THERE IS A QUESTION ON THE NOTE.
    ":GOSUB2570                   :rem 21
435 GOSUB1320:IFWR=1THENGOTO160   :rem 193
440 PR$=DS$(12):GOSUB2570:PR$=DS$(13):GOS
    UB2570:FD=1:MB=0:GOTO340      :rem 57
450 GOSUB790:PRINT"{CLR}{7 DOWN}";  :rem 9
470 PR$="A TRAP DOOR OPENS BENEATH YOUR F
    EET AND YOU BEGIN SLIDING DOWN A "
                                  :rem 53
480 PR$=PR$+"CHUTE. YOU PASS A NEON SIGN
    {SPACE}THAT SAYS :":GOSUB2570:PRINT
                                  :rem 75
490 PR$="{11 SPACES}'MATH DUNGEON'":GOSUB
    2570                         :rem 244
500 PRINT:PR$="{13 SPACES}'LEVEL "+STR$(L
    V)+"'":GOSUB2570:PRINT:PRINT  :rem 41
510 PR$="PRESS ANY KEY TO CONTINUE":GOSUB
    2570                         :rem 203
520 GETA$:IFA$=""THEN520          :rem 81
530 LT=1:PX=INT(RND(1)*10)+1:PY=INT(RND(1
    )*10)+1:FL(PY,PX)=2             :rem 0
540 GOSUB790:CM(9)=1:FORI=12TO19:CM(I)=1:
    NEXT:CM(9)=LT:CM(22)=1        :rem 251
550 IFFL(PY,PX)=2THENPRINT"{CLR}":PR$=DS$
    (14):GOSUB2570                :rem 193
560 IFFL(PY,PX)=1THENPRINT"{CLR}":PR$=DS$
    (15):GOSUB2570                :rem 194
570 IFLT=1THENPR$=DS$(16):GOSUB2570
                                  :rem 102
580 GOSUB2310                     :rem 227
590 IFPL=9THENGOSUB950:GOTO580    :rem 156
600 IFPL=12THENGOSUB970:GOTO580   :rem 192
610 IFPL=13THENGOSUB1000:GOTO580  :rem 227
620 IFPL=15ANDLO=0THEN550          :rem 10
630 IFPL=15ANDLO=1THENGOSUB1020:GOTO570
                                  :rem 196
640 IFPL=14THEN580                :rem 51
650 IFPL=22THENGOSUB2470:GOTO670  :rem 243
660 IFPL>15THENGOSUB1560:IF(LO=0)OR(WA=1)
    THEN580                       :rem 204
670 ONZGOSUB1860,1860,2000        :rem 204
680 GOTO670                       :rem 116
690 END                           :rem 118
700 PRINT"{CLR}{9 DOWN}":IFCC=40THENPRINT
    TAB(10);:GOTO720              :rem 16
710 PRINTTAB(1);                  :rem 185
720 PRINT"{4 SPACES}MATH DUNGEON
    {3 SPACES}":PRINT"{DOWN}":IFCC=40THEN
    PRINTTAB(12);:GOTO740         :rem 64
730 PRINTTAB(4);                  :rem 190
740 PRINT"A MATH ADVENTURE"       :rem 133
750 PRINT"{HOME}{21 DOWN}"TAB(8);:PR$="EN
    TER DESIRED LEVEL(1-5)"       :rem 219
760 GOSUB2570:PRINTTAB(8);:INPUTLV:IFLV<1
    ORLV>5THENGOTO750             :rem 75
770 FORI=1TO22:READCM$(I):NEXT:FORI=1TO5:
    READIN$(I):NEXT               :rem 52
780 FORI=1TO29:READDS$(I):NEXT:RETURN
                                  :rem 137
790 FORI=1TO22:CM(I)=0:NEXTI:IFIN(5)=1THE
    NCM(20)=1:RETURN              :rem 38
800 IFPL=2ANDGT=1THENPR$="THE GATE IS ALR
    EADY OPEN.":GOSUB2570         :rem 12
810 IFPL=2ANDGT=0THENGT=1:PRINT"OK."
                                  :rem 25
820 IFPL=5ANDGT=0THENPR$="THE GATE IS ALR
    EADY CLOSED.":GOSUB2570       :rem 152
830 IFPL=5ANDGT=1THENGT=0:PRINT"OK."
                                  :rem 30
840 RETURN                        :rem 124
```

```
850 IFPL=1ANDFD=1THENPR$="THE DOOR IS ALR
    EADY OPEN.":GOSUB2570          :rem 18
860 IFPL=1ANDFD=0THENFD=1:PRINT"OK."
                                   :rem 251
870 IFPL=4ANDFD=0THENPR$="THE DOOR IS ALR
    EADY CLOSED.":GOSUB2570        :rem 158
880 IFPL=4ANDFD=1THENFD=0:PRINT"OK."
                                   :rem 0
890 RETURN                         :rem 129
900 IFPL=3ANDMB=1THENPR$="THE MILKBOX IS
    {SPACE}ALREADY OPEN.":GOSUB2570
                                   :rem 247
910 IFPL=3ANDMB=0THENMB=1:PRINT"OK.":CM(7
    )=1                            :rem 195
920 IFPL=6ANDMB=0THENPR$="THE MILKBOX IS
    {SPACE}ALREADY CLOSED.":GOSUB2570
                                   :rem 131
930 IFPL=6ANDMB=1THENMB=0:PRINT"OK.":CM(7
    )=0                            :rem 199
940 RETURN                         :rem 125
950 IFIN(1)=1THENPR$="YOU ALREADY HAVE TH
    E LIGHT.":GOSUB2570:RETURN     :rem 118
960 IFLT=1THENLT=0:IN(1)=1:PRINT"OK.":CM(
    9)=0:RETURN                    :rem 231
970 IFIN(1)=0THENPR$="YOU DO NOT HAVE A L
    IGHT.":GOSUB2570:RETURN        :rem 89
980 IFLO=0THENPRINT"OK.":LO=1:RETURN
                                   :rem 93
990 IFLO=1THENPR$="THE LIGHT IS ALREADY O
    N.":GOSUB2570:RETURN           :rem 20
1000 IFLO=0THENPR$="THE LIGHT IS ALREADY
     {SPACE}OFF.":GOSUB2570:RETURN
                                   :rem 112
1010 IFLO=1THENPRINT"OK.":LO=0:RETURN
                                   :rem 126
1020 PRINT"{CLR}"DS$(16-FL(PY,PX)):rem 39
1030 EC=PX+1:DN$="EAST":IFEC=11THENGOTO10
     50                            :rem 73
1040 IFFL(PY,EC)<>0THENGOSUB1120 :rem 177
1050 WC=PX-1:DN$="WEST":IFWC=0THENGOTO107
     0                             :rem 87
1060 IFFL(PY,WC)<>0THENGOSUB1120 :rem 197
1070 NC=PY-1:DN$="NORTH":IFNC=0THENGOTO10
     90                            :rem 146
1080 IFFL(NC,PX)<>0THENGOSUB1120 :rem 189
1090 SC=PY+1:DN$="SOUTH":IFSC=11THENGOTO1
     110                           :rem 207
1100 IFFL(SC,PX)<>0THENGOSUB1120 :rem 187
1110 RETURN                        :rem 163
1120 PRINTDN$" IS A DOORWAY.":RETURN
                                   :rem 149
1130 IFGK=0ANDBK=0ANDRK=0THENPRINT"WHAT K
     EY?":RETURN                   :rem 115
1140 PRINT"OK."                    :rem 95
1150 IFGKTHENGK=0:IN(2)=1:RETURN :rem 242
1160 IFBKTHENBK=0:IN(3)=1:RETURN :rem 234
1170 IFRKTHENRK=0:IN(4)=1:BD=2:RETURN
                                   :rem 59
1180 RETURN                        :rem 170
1190 IFGD<>1THEN1220               :rem 132
1200 IFIN(2)=0THENPR$=DS$(10):GOSUB2570:R
     ETURN                         :rem 26
1210 IFIN(2)=1THENPR$=DS$(27):GOSUB2570:M
     A=1:CM(11)=1:CM(1)=0:RETURN :rem 254
1220 IFBD<>1THEN1250               :rem 124
1230 IFIN(3)=0THENPR$=DS$(10):GOSUB2570:R
     ETURN                         :rem 30
1240 IFIN(3)=1THENPR$=DS$(28):GOSUB2570:C
     M(8)=1:RK=1:CM(1)=0:RETURN  :rem 232
1250 IFRD<>1THEN1280               :rem 146
1260 IFIN(4)=0THENPR$=DS$(10):GOSUB2570:R
     ETURN                         :rem 34
1270 IFIN(4)=1THENPRINT"{CLR}":PR$=DS$(29
     ):GOSUB2570:GOSUB2520         :rem 53
1280 RETURN                        :rem 171
1290 G=INT(RND(1)*LV*10)+1:PR$="YOU HAVE
     {SPACE}FOUND "+STR$(G)+" GOLD PIECES
     ."                            :rem 31
1300 GOSUB2570:GP=GP+G:PR$="YOU NOW HAVE
     {SPACE}"+STR$(GP)+" GOLD PIECES.":GO
     SUB2570                       :rem 243
1310 CM(10)=0:RETURN               :rem 142
1320 OP=INT(RND(1)*4)+1            :rem 254
1340 IF(LV<=2)AND(OP>=3)THEN1320   :rem 91
1350 PRINT"WHAT IS...";            :rem 47
1360 ONOPGOTO1370,1400,1430,1460 :rem 230
1370 X=INT(RND(1)*LV*10):Y=INT(RND(1)*LV*
     10)                           :rem 34
1380 IFLV>4THENX=X-INT(RND(1)*LV*5):Y=Y-I
     NT(RND(1)*LV*5)               :rem 168
1390 Z1=X+Y:PRINTX" + "Y"?":INPUTZ$:GOSUB
     1510:IFWR=2THEN1390           :rem 129
1395 RETURN                        :rem 178
1400 X=INT(RND(1)*LV*10):Y=INT(RND(1)*LV*
     10)                            :rem 28
1410 IFLV<=3THENIFY>XTHENT=X:X=Y:Y=T
                                   :rem 180
1420 Z1=X-Y:PRINTX" - "Y"?":INPUTZ$:GOSUB
     1510:IFWR=2THEN1420           :rem 121
1425 RETURN                        :rem 172
1430 X=INT(RND(1)*LV*5):Y=INT(RND(1)*LV*5
     )                             :rem 199
1440 IFLV>=4THENX=X-INT(RND(1)*LV*2):Y=Y-
     INT(RND(1)*LV*2)              :rem 220
1450 Z1=X*Y:PRINTX" * "Y"?":INPUTZ$:GOSUB
     1510:IFWR=2THEN1450           :rem 121
1455 RETURN                        :rem 175
1460 X=INT(RND(1)*LV*5):Y=INT(RND(1)*LV*5
     )                             :rem 202
1470 IFLV>=4THENX=X-INT(RND(1)*LV*3):Y=Y-
     INT(RND(1)*LV*3)              :rem 225
1480 IFY=0THENY=1                   :rem 24
1490 Z1=X/Y:IFZ1<>INT(Z1)THEN1460   :rem 5
1500 PRINTX" / "Y"?":INPUTZ$        :rem 66
1505 GOSUB1510:IFWR=2THEN1490      :rem 240
1506 RETURN                        :rem 172
1510 IFVAL(Z$)<>0THENZ2=VAL(Z$):GOTO1540
                                   :rem 153
1520 IFZ$<>"0"THENPR$="ANSWER THE QUESTIO
     N FIRST!":GOSUB2570:WR=2:RETURN
                                   :rem 255
1530 Z2=VAL(Z$)                     :rem 68
1540 IFZ1=Z2THENPRINT"{CLR}CORRECT!!":WR=
     0:RETURN                      :rem 254
1550 PRINT"{CLR}INCORRECT!!":WR=1:RETURN
                                   :rem 133
1560 WA=0:IFLO=0THENPR$="I'D TURN ON MY L
     IGHT FIRST.":GOSUB2570:GOTO1610
                                   :rem 73
1570 C=ABS(PL=18)-ABS(PL=19):D=ABS(PL=17)
     -ABS(PL=16):TX=PX+C:TY=PY+D :rem 121
1580 IFTX=11ORTX=0ORTY=11ORTY=0THENPRINT"
     THERE IS A WALL THERE.":WA=1:GOTO161
     0                             :rem 176
1590 IFFL(TY,TX)=0THENPRINT"THERE IS A WA
     LL THERE.":WA=1:GOTO1610     :rem 217
1600 PX=TX:PY=TY                    :rem 37
1610 Z=FL(PY,PX):RETURN            :rem 217
1620 FORI=1TO10:FORJ=1TO10:FL(I,J)=0:NEXT
     J:NEXTI                       :rem 22
1625 NM=INT(RND(1)*10)+LV:I=1      :rem 145
1630 X=INT(RND(1)*10)+1:Y=INT(RND(1)*10)+
```

```
    1:IFFL(Y,X)=3THEN1630          :rem 51
1640 FL(Y,X)=3:I=I+1:IFI<=NMTHEN1630
                                   :rem 127
1650 FORI=1TONM*2                   :rem 4
1660 X=INT(RND(1)*10)+1:Y=INT(RND(1)*10)+
    1                              :rem 68
1670 IFFL(Y,X)=3THEN1660           :rem 137
1680 FL(Y,X)=0:NEXTI               :rem 190
1690 FORI=1TO10:FORJ=1TO10          :rem 79
1700 IFFL(I,J)=3THENGOSUB1780      :rem 232
1710 NEXTJ:NEXTI                    :rem 20
1720 GOSUB1840:GX=X:GY=Y:IF(BX=XANDBY=Y)O
    R(RX=XANDRY=Y)ORFL(Y,X)=0THEN1720
                                   :rem 78
1730 GOSUB1840:BX=X:BY=Y:IF(GX=XANDGY=Y)O
    R(RX=XANDRY=Y)ORFL(Y,X)=0THEN1730
                                   :rem 80
1740 GOSUB1840:X1=X:Y1=Y:IF(X2=XANDY2=Y)O
    R(X3=XANDY3=Y)ORFL(Y,X)=0THEN1740
                                   :rem 200
1750 GOSUB1840:X2=X:Y2=Y:IF(X1=XANDY1=Y)O
    R(X3=XANDY3=Y)ORFL(Y,X)=0THEN1750
                                   :rem 202
1760 GOSUB1840:X3=X:Y3=Y:IF(X1=XANDY1=Y)O
    R(X2=XANDY2=Y)ORFL(Y,X)=0THEN1760
                                   :rem 204
1770 RETURN                        :rem 175
1780 FORK=JTO10:GOSUB1800:NEXTK:FORK=JTO1
    STEP-1:GOSUB1800:NEXTK         :rem 124
1790 FORK=ITO10:GOSUB1820:NEXTK:FORK=ITO1
    STEP-1:GOSUB1820:NEXTK:RETURN
                                   :rem 153
1800 IFFL(I,K)=0THENFL(I,K)=INT(RND(1)*2)
    +1                             :rem 209
1810 RETURN                        :rem 170
1820 IFFL(K,J)=0THENFL(K,J)=INT(RND(1)*2)
    +1                             :rem 213
1830 RETURN                        :rem 172
1840 X=INT(RND(1)*10)+1:Y=INT(RND(1)*10)+
    1:IFFL(Y,X)=0THEN1840           :rem 54
1850 RETURN                        :rem 174
1860 GOSUB790:FORI=12TO19:CM(I)=1:NEXT:CM
    (22)=1                          :rem 62
1870 PRINT"{CLR}":PR$=DS$(16-Z):GOSUB2570
    :IFLO=1THENGOSUB1030           :rem 56
1880 GOSUB2270:GOSUB2200           :rem 154
1890 GOSUB2310:IFPL=15ANDLOTHENGOSUB1020:
    GOTO1880                       :rem 68
1900 IFPL=20THENGOSUB2850:GOTO1890:rem 87
1910 IFPL=15ANDLO=0THEN1870        :rem 115
1920 IFPL=1THENGOSUB1190:GOTO1890  :rem 36
1930 IFPL=14THEN1890               :rem 155
1940 IFPL=11THENGOSUB2490:GOTO1890:rem 91
1950 IFPL=8THENGOSUB1130:GOTO1890  :rem 40
1960 IFPL=22THENGOSUB2470:RETURN   :rem 50
1970 IFPL>15THENGOSUB1560:IF(LO=0)OR(WA=1
    )THEN1890                      :rem 54
1980 RETURN                        :rem 178
2000 GOSUB790:FORI=10TO19:CM(I)=1:NEXTI:C
    M(22)=1                        :rem 120
2010 PR$=DS$(23):GOSUB2570:PR$=DS$(24):GO
    SUB2570:GOSUB1320:IFWR=0THENGOTO2050
                                   :rem 132
2020 GP=0:PR$=DS$(25):GOSUB2570:FORW=1TO2
    000:NEXTW                      :rem 27
2030 X=INT(RND(1)*10+1):Y=INT(RND(1)*10)+
    1:IFFL(Y,X)=0THEN2030          :rem 38
2040 PX=X:PY=Y:Z=FL(PY,PX):RETURN:rem 199
2050 PR$=DS$(26):GOSUB2570:FL(PY,PX)=2
                                   :rem 207
2060 PR$=DS$(14):GOSUB2570:IFLOTHENGOSUB1
    030                            :rem 155
2070 GOSUB2270:GOSUB2200           :rem 146
2080 GOSUB2310                      :rem 16
2090 IFPL=20THENGOSUB2850:GOTO2080:rem 80
2100 IFPL=15ANDLOTHENGOSUB1020:GOTO2070
                                   :rem 173
2110 IFPL=15ANDLO=0THEN2060        :rem 100
2120 IFPL=14THEN2080               :rem 139
2130 IFPL=11THEN2490:GOTO2080      :rem 203
2140 IFPL=8THENGOSUB1130:GOTO2080 :rem 24
2150 IFPL=1THENGOSUB1190:GOTO2080 :rem 24
2160 IFPL=10THENGOSUB1290:GOTO2080:rem 74
2170 IFPL=22THENGOSUB2470:RETURN  :rem 44
2180 IFPL>15THENGOSUB1560:IF(LO=0)OR(WA=1
    )THEN2080                      :rem 40
2190 RETURN                        :rem 172
2200 IF(X1=PXANDY1=PY)ANDGD<>2THENPR$=DS$
    (17):GOSUB2570:GD=1:CM(1)=1 :rem 122
2210 IF(X2=PXANDY2=PY)ANDBD<>2THENPR$=DS$
    (19):GOSUB2570:BD=1:CM(1)=1 :rem 117
2220 IF(X3=PXANDY3=PY)ANDRD<>2THENPR$=DS$
    (18):GOSUB2570:RD=1:CM(1)=1 :rem 151
2230 IF(X1<>PXORY1<>PY)ANDGD<>2THENGD=0
                                   :rem 209
2240 IF(X2<>PXORY2<>PY)ANDBD<>2THENBD=0
                                   :rem 202
2250 IF(X3<>PXORY3<>PY)ANDRD<>2THENRD=0
                                   :rem 237
2260 RETURN                        :rem 170
2270 IFBX=PXANDBY=PYANDIN(3)=0THENPR$=DS$
    (21):GOSUB2570:BK=1:CM(8)=1 :rem 167
2280 IFGX=PXANDGY=PYANDIN(2)=0THENPR$=DS$
    (20):GOSUB2570:GK=1:CM(8)=1 :rem 181
2290 IFRX=PXANDRY=PYANDIN(4)=0THENPR$=DS$
    (22):GOSUB2570:RK=1:CM(8)=1 :rem 219
2300 RETURN                        :rem 165
2310 INPUTC$:PL=0:FORI=1TO22:IFCM$(I)=C$T
    HENPL=I:I=23                    :rem 16
2320 NEXT                           :rem 6
2330 IFPL=0THENPRINT"YOU CAN'T DO THAT!":
    GOTO2310                       :rem 200
2340 N$="":I=1                     :rem 173
2350 T$=MID$(C$,I,1)                :rem 7
2360 IFASC(T$)=32THENL=I:GOTO2390:rem 222
2370 IFI=LEN(C$)THENGOTO2410       :rem 167
2380 I=I+1:GOTO2350                 :rem 53
2390 N$=MID$(C$,L+1,LEN(C$))       :rem 202
2400 IFCM(PL)=0THENPRINT"I SEE NO "N$" HE
    RE!":GOTO2310                  :rem 54
2410 IFC$="INV"THENGOTO2430        :rem 92
2420 RETURN                        :rem 168
2430 PRINT"YOU ARE CARRYING :"      :rem 8
2440 FORI=1TO5:IFIN(I)=1THENPRINT"A "IN$(
    I)                             :rem 62
2450 NEXTI:IFGP<>0THENPRINTGP" GOLD PIECE
    S."                             :rem 1
2460 RETURN                        :rem 172
2470 PX=INT(RND(1)*10)+1:PY=INT(RND(1)*10
    )+1:IFFL(PY,PX)=0THEN2470      :rem 118
2480 Z=FL(PY,PX):RETURN            :rem 223
2490 IFIN(5)=1THENPR$="YOU ALREADY HAVE T
    HE MAP!":GOSUB2570:RETURN       :rem 4
2500 IFMA=0THENPRINT"WHAT MAP?":RETURN
                                   :rem 188
2510 PRINT"OK.":IN(5)=1:MA=0:CM(20)=1:GD=
    2:RETURN                       :rem 148
2520 PR$="{2 DOWN}YOU HAVE FOUND YOUR WAY
     OUT OF THE MATH DUNGEON.":GOSUB2570
                                   :rem 109
2530 PR$="{DOWN}{2 SPACES}YOU HAVE WON "+
    STR$(GP)+" GOLD PIECES IN YOUR JOURN
```

```
     EY.":GOSUB2570                    :rem 125
2540 PRINT"{DOWN} PLAY AGAIN";:INPUT A$
                                       :rem 173
2550 IFA$="Y"THENRUN                   :rem 190
2560 END                               :rem 164
2570 IFLEN(PR$)<=CCTHENPRINTPR$:RETURN
                                       :rem 238
2580 T$=MID$(PR$,CC,1):IFASC(T$)=32THENI=
     CC:GOTO2620                       :rem 43
2590 I=CC-1                            :rem 58
2600 T$=MID$(PR$,I,1):IFASC(T$)=32THENGOT
     O2620                             :rem 161
2610 I=I-1:GOTO2600                    :rem 49
2620 A$=MID$(PR$,I+1,LEN(PR$)):B$=MID$(PR
     $,1,I-1):PRINTB$                  :rem 195
2630 IFLEN(A$)<=CCTHENPRINTA$:RETURN
                                       :rem 41
2640 PR$=A$:GOTO2570                   :rem 117
2650 DATAOPEN DOOR,OPEN GATE,OPEN MILKBOX
     ,CLOSE DOOR,CLOSE GATE,CLOSE MILKBOX
                                       :rem 145
2660 DATAGET NOTE,GET KEY,GET LIGHT,GET G
     OLD,GET MAP,LIGHT ON,LIGHT OFF,INV
                                       :rem 108
2670 DATALOOK,N,S,E,W,MAP,MAP,ALGEBRA,LIG
     HT,GREEN KEY,BLUE KEY,RED KEY,MAP
                                       :rem 154
2680 DATAYOU ARE FACING NORTH. A GATE IS
     {SPACE}IN FRONT OF YOU.,THE GATE IS
     {SPACE}OPEN.                      :rem 40
2690 DATATHE GATE IS CLOSED.,YOU ARE IN A
      DENSE FOREST.                    :rem 186
2700 DATAYOU ARE IN FRONT OF AN OLD HOUSE
     . THERE IS A MILKBOX BY THE DOOR.
                                       :rem 214
2710 DATATHE MILKBOX IS CLOSED.,THE MILKB
     OX IS OPEN.,THE DOOR IS CLOSED.
                                       :rem 67
2720 DATATHE DOOR IS OPEN.,THE DOOR IS LO
     CKED. YOU DO NOT HAVE THE RIGHT KEY.
                                       :rem 206
2730 DATATHERE IS A NOTE IN THE MILKBOX.,
     THE DOOR FLIES OPEN WITH A BANG!
                                       :rem 201
2740 DATATHE NOTE DISAPPEARS AND THE MILK
     BOX CLOSES.                       :rem 171
2750 DATAYOU ARE IN A COLD AND DAMP ROOM.
     ,YOU ARE IN A LONG AND NARROW HALLWA
     Y.                                :rem 12
2760 DATATHERE IS AN UNLIT LIGHT HERE.,TH
     ERE IS A GREEN DOOR HERE.         :rem 90
2770 DATATHERE IS A RED DOOR HERE.,THERE
     {SPACE}IS A BLUE DOOR HERE.       :rem 207
2780 DATATHERE IS A GREEN KEY HERE.,THERE
      IS A BLUE KEY HERE.              :rem 208
2790 DATATHERE IS A RED KEY HERE.,BEFORE
     {SPACE}YOU CAN GET A GOOD LOOK AT TH
     E AREA..                          :rem 111
2800 DATAA MONSTER JUMPS OUT AND SAYS 'YO
     U MUST ANSWER THIS QUESTION!:rem 245
2810 DATA'NOW I'LL TAKE ALL YOUR GOLD AND
      TRANSPORT YOU AWAY!              :rem 107
2820 DATATHE MONSTER DISAPPEARS.
     {17 SPACES}YOU SEE SOME GOLD HERE!
                                       :rem 130
2830 DATATHERE IS A MAP HERE!,THERE IS A
     {SPACE}RED KEY HERE!              :rem 233
2840 DATATHERE IS A SUDDEN FLASH AND YOU
     {SPACE}FIND YOURSELF AMIDST SOME TRE
     ES.                               :rem 127
2850 IFIN(5)=0THENPRINT"YOU DON'T HAVE A
     {SPACE}MAP!":RETURN               :rem 191
2860 PRINT"{CLR}":PRINT                :rem 251
2870 FORI=1TO10:TB=1:FORJ=1TO10        :rem 142
2880 IFI=PYANDJ=PXTHENPRINTTAB(TB)"{GRN}*
     ";:GOTO2930                       :rem 20
2890 IFFL(I,J)=3THENPRINTTAB(TB)"{BLK}M";
     :GOTO2930                         :rem 139
2900 IFFL(I,J)=2THENPRINTTAB(TB)"{BLU}R";
     :GOTO2930                         :rem 22
2910 IFFL(I,J)=1THENPRINTTAB(TB)"{PUR}H";
     :GOTO2930                         :rem 137
2920 PRINTTAB(TB)"{RVS}{YEL} {OFF}";
                                       :rem 217
2930 TB=TB+2:NEXTJ:PRINT:PRINT:NEXTI
                                       :rem 167
2940 PRINT"{BLU}":RETURN               :rem 217
```

Chomper

Article on page 56.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1—Chomper—VIC Version

```
10 PRINT"{CLR}"SPC(183)"CHOMPER":FORI=1TO
   2000:NEXT:GOTO610                   :rem 170
20 M=M+1:X=45+G-INT(TI/60):IFX<0THEN240
                                       :rem 44
30 PRINT"{RVS}{HOME}"SPC(7)"TIME"X"{LEFT}
    ":GOSUB590:X=X+X1:Y=Y+Y1:IFY=0THENY=2
   2                                   :rem 60
40 IFY=23THENY=1                       :rem 228
50 IFX=-1THENX=21                      :rem 14
60 IFX=22THENX=0                       :rem 226
70 IF-((PAND32)=0)THEN510              :rem 127
80 POKEC,32:C=FNA(0):X1=X:Y1=Y:Z=PEEK(C):
   IFZ=32THENPOKEC,36:GOTO140          :rem 186
90 POKEC,37:POKEVO,8:IFZ=34THENS=S+150:GO
   SUB190:GOTO120                      :rem 215
100 IFZ=35THENS=S-450:GOSUB200:GOTO130
                                       :rem 74
110 POKEC,33:GOTO250                   :rem 160
120 IFS>=LTHENPOKES2,0:POKES3,0:GOTO210
                                       :rem 204
130 POKES1,0:POKES2,0:POKES3,0:POKES4,0:P
    RINT"{RVS}{HOME}{RIGHT}{LEFT}"S"
    {LEFT} "                           :rem 162
135 REM**DROIDS' ROUTINE**             :rem 55
140 Z=M/F:IFZ<>INT(Z)THEN20            :rem 178
150 IFW=C1THENW=0                      :rem 32
160 W=W+1:X=X(W):Y=Y(W):X=X+(-(X1>X)+(X1<
    X)):Y=Y+(-(Y1>Y)+(Y1<Y)):POKED(W),32
                                       :rem 28
170 D(W)=FNA(0):X(W)=X:Y(W)=Y:Z=PEEK(D(W)
    ):POKED(W),33:IFZ>35THEN250        :rem 96
180 GOTO20                             :rem 52
185 REM*SOUND ROUTINES                 :rem 174
190 FORX=160TO198STEP3:POKES2,X:POKES3,X:
    NEXTX:RETURN                       :rem 49
200 POKES4,178:POKES1,178:FORX=150TO1STEP
    -3:POKEVO,(X/10):NEXT:POKEVO,8:RETURN
                                       :rem 1
```

```
205 REM**BONUS**                          :rem 170
210 V=V+1:PRINT"{RVS}{HOME}"SPC(15)"*EX*
    {2 SPACES}{2 LEFT}"V:L=S+2999:G=G+R:R
    =R-5:IFV<>6THEN20                     :rem 231
220 PRINT"{CLR}{RVS}"SPC(5)"BONUS SCREEN
    {SPACE}":FORX=1TO750:NEXT:PRINT"{CLR}
    ":M=0:G=0:R=45                        :rem 82
230 PRINT"{RVS}{HOME}"SPC(15)"*EX*
    {2 SPACES}{2 LEFT}"V:GOTO510          :rem 246
235 REM**GAME OVER**                      :rem 124
240 PRINT"{HOME}":FORX=1TO10:PRINT:NEXT:P
    RINT"{RVS}{6 SPACES}TIME'S UP":FORX=1
    TO1000:NEXT:GOTO260                   :rem 223
250 FORX=230TO150STEP-1:POKES3,X:POKES1,X
    :NEXT:POKES3,0:POKES1,0               :rem 108
260 PRINT"{HOME}":FORX=1TO11:PRINT:NEXT:P
    RINTSPC(6)"{RVS}GAME OVER"            :rem 136
270 FORZ=1TO100STEP4:POKE36879,Z:POKES2,1
    28+ABS(INT(SIN(Z)*127)):NEXT:POKES2,0
                                          :rem 75
275 FORI=1TO1000:NEXT                     :rem 25
280 POKE36879,110:PRINT"{CLR}":POKE36869,
    240                                   :rem 113
285 REM**HIGH SCORE?**                    :rem 6
290 IFS<BSTHEN310                         :rem 17
300 BS=S:PRINT"{CLR}"SPC(5)"GREAT SCORE!!
    ":PRINT"{HOME}{3 DOWN} INPUT YOUR NAM
    E":INPUT" ";N$                        :rem 67
305 REM**AGAIN?**                         :rem 195
310 FORI=1TO1000:NEXT                     :rem 15
311 PRINT"{CLR}{3 DOWN}{5 RIGHT}SCORE:";S
    :PRINT"{3 DOWN}{2 RIGHT}SESSION HIGH:
    ";BS:PRINTSPC(8)"BY"                  :rem 220
320 PRINT"{2 RIGHT}";N$:PRINT"{HOME}":FOR
    Z=1TO11:PRINT:NEXT:PRINTSPC(6)"TRY AG
    AIN?"                                 :rem 175
330 PRINT:PRINTSPC(7)"YES{DOWN}"          :rem 158
340 PRINTSPC(8)"W":PRINTSPC(7)"W W NEW GA
    ME":PRINTSPC(8)"W":PRINTSPC(8)"{DOWN}
    NO"                                   :rem 82
350 GOSUB590:IFX=1THEN390                 :rem 16
360 IFY=-1THENM=-1:GOTO390                :rem 66
370 IFY=1THENPOKE36879,27:PRINT"{CLR}
    {BLU}":END                            :rem 194
380 GOTO350                               :rem 108
385 REM**VAR SETUP**                      :rem 166
390 PRINT"{CLR}":POKE36869,240:POKE36879,
    110:X=0:Y=0:Z=0:L=3000:S=0:G=0:V=0:R=
    45:W=0                                :rem 14
400 X1=11:Y1=11:C=7933:DEF FNA(A)=7680+Y*
    22+X:DEF FNB(A)=INT(RND(TI)*A+1)
                                          :rem 73
410 S1=36874:S2=36875:S3=36876:S4=36877:V
    O=36878:D=37154:PA=37137:PB=37152:POK
    E37139,0                              :rem 82
420 IFM<0THENM=0:GOTO510                  :rem 208
425 REM**LEVEL?**                         :rem 222
430 M=0:PRINT"{CLR}{WHT}ENTER LEVEL":PRIN
    T"{3 DOWN}{3 SPACES}TWO DROIDS":PRINT
    "{DOWN}"SPC(8)"W"                     :rem 141
440 PRINT"{2 SPACES}HARD W W EASY":PRINTS
    PC(8)"W":PRINT"{2 DOWN}{3 SPACES}USE
    {SPACE}JOYSTICK"                      :rem 67
450 FORZ=1TO600:NEXT                      :rem 250
460 GOSUB590:IFX=-1THENC1=1:F=3:GOTO500
                                          :rem 125
470 IFX=1THENC1=1:F=4:GOTO500             :rem 250
480 IFY=-1THENC1=2:F=2:GOTO500            :rem 40
490 GOTO460                               :rem 112
500 PRINT"{CLR}"                          :rem 249
505 REM**SCREEN SETUP**                   :rem 119
510 POKE36869,255:FORA=34TO35:FORY=1TO70
                                          :rem 160
520 X=7701+FNB(484):Z=FNB(8)-1:IFZ=6THENZ
    =7                                    :rem 14
530 IFZ=2THENZ=3                          :rem 233
540 POKE30720+X,Z:POKEX,A:NEXTY,A         :rem 58
550 POKEVO,8:FORX=128TO255:POKES2,X:NEXT:
    POKES2,0:POKEC,36:IFM<>0THEN20:rem 41
555 REM**DROID SETUP**                    :rem 46
560 FORZ=1TOC1:X=FNB(22)-1:Y=FNB(22):D(Z)
    =FNA(0):X(Z)=X:Y(Z)=Y                 :rem 214
570 POKED(Z),33:NEXT                      :rem 197
580 TI$="000000":GOTO20                   :rem 212
585 REM**JOYSTICK**                       :rem 158
590 POKED,127:P=PEEK(PA):X=-((PEEK(PB)AND
    128)=0)+((PAND16)=0):POKED,255:rem 95
600 Y=(-((PAND8)=0))+((PAND4)=0):RETURN
                                          :rem 191
605 REM**CHARACTERS**                     :rem 7
610 FORX=7424TO7431:POKEX,0:NEXT:FORY=33T
    O37:FORX=0TO7:READZ:POKE7168+8*Y+X,Z:
    NEXTX,Y                               :rem 10
630 DATA 60,66,90,66,60,36,36,102,0,0,0,2
    4,24,0,0,0,126,129,165,129,153,189,12
    9,126                                 :rem 226
640 DATA 60,126,90,126,235,129,213,126,60
    ,126,90,255,255,255,255,126:GOTO390
                                          :rem 46
```

Program 2—Chomper—64 Version

Program translation by Kevin Mykytyn.

```
49152 :032,136,198,169,162,141,070
49158 :095,195,169,003,141,112,209
49164 :003,169,016,141,114,003,202
49170 :169,039,141,115,003,169,142
49176 :000,141,032,208,141,033,067
49182 :208,169,147,032,210,255,027
49188 :032,229,192,160,007,185,073
49194 :035,198,153,123,005,136,180
49200 :016,247,160,010,185,043,197
49206 :198,153,198,005,136,016,248
49212 :247,169,001,141,107,003,216
49218 :160,005,185,054,198,153,053
49224 :027,006,136,016,247,169,161
49230 :001,141,113,003,165,162,151
49236 :105,010,197,162,208,252,250
49242 :173,112,003,141,203,005,215
49248 :173,107,003,009,048,141,065
49254 :083,005,173,000,220,074,145
49260 :176,016,238,107,003,173,053
49266 :107,003,041,007,240,246,246
49272 :141,107,003,076,082,192,209
49278 :074,176,001,000,074,176,115
49284 :008,169,210,141,111,003,006
49290 :076,191,192,074,176,007,086
49296 :169,160,141,111,003,208,168
49302 :040,074,176,029,173,113,243
49308 :003,208,179,173,095,195,241
49314 :073,011,141,095,195,173,082
49320 :112,003,073,001,141,112,098
49326 :003,169,001,141,113,003,092
49332 :076,082,192,169,000,141,072
49338 :113,003,076,082,192,032,172
49344 :192,195,032,029,196,032,100
49350 :249,192,032,081,195,032,211
49356 :052,194,032,000,194,032,196
49362 :067,193,032,004,193,032,219
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49368 :088,193,032,153,196,173,027
49374 :141,002,240,233,076,221,111
49380 :192,169,001,160,000,153,135
49386 :000,216,153,000,217,153,205
49392 :000,218,153,000,219,136,198
49398 :208,241,096,160,018,185,130
49404 :077,198,153,010,004,136,062
49410 :016,247,056,173,077,003,062
49416 :237,062,003,141,079,003,021
49422 :173,078,003,237,063,003,059
49428 :013,079,003,176,041,238,058
49434 :081,003,173,077,003,024,131
49440 :105,184,141,077,003,173,203
49446 :078,003,105,011,141,078,198
49452 :003,173,073,003,024,109,173
49458 :076,003,141,073,003,173,007
49464 :076,003,240,006,056,233,158
49470 :005,141,076,003,096,169,040
49476 :000,141,064,003,173,062,255
49482 :003,141,071,003,173,063,016
49488 :003,141,072,003,032,151,226
49494 :193,096,169,015,141,064,252
49500 :003,173,073,003,141,065,038
49506 :003,169,000,141,066,003,224
49512 :032,168,193,173,081,003,242
49518 :141,065,003,169,000,141,117
49524 :066,003,169,032,141,064,079
49530 :003,032,168,193,096,206,052
49536 :075,003,208,018,206,073,199
49542 :003,173,073,003,201,255,074
49548 :208,003,076,130,197,169,155
49554 :009,141,075,003,096,173,131
49560 :071,003,056,233,016,141,160
49566 :065,003,173,072,003,233,195
49572 :039,141,066,003,169,000,070
49578 :141,067,003,141,068,003,081
49584 :141,069,003,162,015,014,068
49590 :065,003,046,066,003,120,229
49596 :248,173,067,003,109,067,087
49602 :003,141,067,003,173,068,137
49608 :003,109,068,003,141,068,080
49614 :003,173,069,003,109,069,120
49620 :003,141,069,003,216,088,220
49626 :202,016,216,162,002,189,237
49632 :067,003,072,074,074,074,076
49638 :074,032,244,193,104,041,150
49644 :015,032,244,193,202,016,170
49650 :236,096,009,048,238,064,165
49656 :003,172,064,003,153,000,131
49662 :004,096,165,162,105,005,023
49668 :197,162,208,252,032,127,214
49674 :193,096,165,162,197,162,217
49680 :240,252,096,072,138,024,070
49686 :101,251,133,251,165,252,151
49692 :105,000,133,252,104,096,206
49698 :072,134,254,165,251,056,198
49704 :229,254,133,251,165,252,044
49710 :233,000,133,252,104,096,096
49716 :160,000,173,060,003,133,069
49722 :251,173,061,003,133,252,163
49728 :169,032,145,251,173,000,066
49734 :220,074,176,005,162,040,235
49740 :032,034,194,074,176,005,079
49746 :162,040,032,019,194,074,091
49752 :176,005,162,001,032,034,242
49758 :194,074,176,005,162,001,194
49764 :032,019,194,074,176,003,086
49770 :032,081,195,165,251,233,039
49776 :039,141,079,003,165,252,023
49782 :233,004,013,079,003,176,114
49788 :013,165,251,024,105,192,106
49794 :133,251,165,252,105,003,015
49800 :133,252,165,251,233,232,122
49806 :141,079,003,165,252,233,247
49812 :007,013,079,003,144,013,151
49818 :165,251,056,233,192,133,160
49824 :251,165,252,233,003,133,173
49830 :252,177,251,201,035,208,010
49836 :042,173,062,003,024,105,069
49842 :150,141,062,003,173,063,002
49848 :003,105,000,141,063,003,243
49854 :201,253,144,003,076,182,025
49860 :198,169,038,141,070,003,047
49866 :169,129,141,004,212,169,002
49872 :009,141,001,212,076,063,198
49878 :195,162,128,142,004,212,033
49884 :206,109,003,174,109,003,056
49890 :142,001,212,224,010,208,255
49896 :005,162,034,142,011,212,030
49902 :162,037,142,070,003,201,085
49908 :036,208,065,056,173,062,076
49914 :003,233,209,141,079,003,150
49920 :173,063,003,233,040,013,013
49926 :079,003,176,013,169,016,206
49932 :141,062,003,169,039,141,055
49938 :063,003,076,040,195,173,056
49944 :062,003,056,233,194,141,201
49950 :062,003,173,063,003,233,055
49956 :001,141,063,003,169,035,192
49962 :141,011,212,169,020,141,224
49968 :008,212,141,109,003,076,085
49974 :063,195,201,034,208,003,246
49980 :076,130,197,160,000,173,028
49986 :070,003,145,251,165,251,183
49992 :141,060,003,165,252,141,066
49998 :061,003,096,160,000,173,059
50004 :027,212,074,074,074,074,107
50010 :074,201,006,240,244,169,000
50016 :001,153,040,216,153,000,147
50022 :217,153,000,218,153,230,049
50028 :218,200,208,227,162,027,126
50034 :032,127,193,202,208,250,102
50040 :162,070,169,232,133,253,115
50046 :169,003,133,254,160,004,081
50052 :173,027,212,024,101,253,154
50058 :133,253,165,254,105,000,024
50064 :133,254,136,208,239,165,255
50070 :253,056,233,040,165,254,127
50076 :233,004,144,218,160,000,147
50082 :173,027,212,016,004,169,251
50088 :035,208,002,169,036,145,251
50094 :253,032,012,194,202,208,051
50100 :197,160,039,169,001,153,131
50106 :000,216,136,016,250,096,132
50112 :120,165,001,041,251,133,135
50118 :001,160,000,185,000,208,240
50124 :153,000,056,185,000,209,039
50130 :153,000,057,136,208,241,237
50136 :165,001,009,004,133,001,017
50142 :173,024,208,041,240,009,149
50148 :014,141,024,208,088,160,095
50154 :039,185,245,195,153,016,043
50160 :057,136,016,247,096,060,084
50166 :066,090,066,060,036,036,088
50172 :102,000,000,000,024,024,146
50178 :000,000,000,126,129,165,166
50184 :129,153,189,129,126,060,026
50190 :126,090,126,235,129,213,165
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50196 :126,060,126,090,255,255,164
50202 :255,255,126,169,147,032,242
50208 :210,255,169,006,141,032,077
50214 :208,141,033,208,169,016,045
50220 :141,062,003,169,039,141,087
50226 :063,003,169,204,141,060,178
50232 :003,169,005,141,061,003,182
50238 :169,048,141,073,003,169,153
50244 :045,141,076,003,169,009,255
50250 :141,075,003,169,199,141,034
50256 :077,003,169,050,141,078,086
50262 :003,169,000,141,081,003,227
50268 :162,008,169,006,157,093,175
50274 :003,173,027,212,157,083,241
50280 :003,202,016,242,169,003,227
50286 :141,108,003,160,023,169,202
50292 :000,153,000,212,136,016,121
50298 :250,169,015,141,024,212,165
50304 :169,017,141,005,212,141,045
50310 :012,212,169,245,141,006,151
50316 :212,141,013,212,169,129,248
50322 :141,015,212,141,018,212,117
50328 :096,169,000,141,082,003,131
50334 :173,027,212,205,111,003,121
50340 :176,003,076,069,197,173,090
50346 :060,003,172,061,003,032,245
50352 :084,197,142,104,003,141,079
50358 :103,003,172,082,003,185,218
50364 :083,003,133,251,185,093,168
50370 :003,168,133,252,165,251,142
50376 :032,084,197,142,106,003,252
50382 :141,105,003,169,032,160,048
50388 :000,145,251,173,105,003,121
50394 :205,103,003,240,015,144,160
50400 :008,162,001,032,034,194,143
50406 :076,238,196,162,001,032,167
50412 :019,194,173,106,003,205,168
50418 :104,003,240,015,144,008,244
50424 :162,040,032,034,194,076,018
50430 :005,197,162,040,032,019,197
50436 :194,160,000,177,251,201,219
50442 :037,144,003,076,130,197,085
50448 :201,034,208,013,172,082,214
50454 :003,185,083,003,133,251,168
50460 :185,093,003,133,252,172,098
50466 :082,003,165,251,153,083,003
50472 :003,165,252,153,093,003,197
50478 :160,000,169,034,145,251,037
50484 :165,251,024,105,000,133,218
50490 :251,165,252,105,212,133,152
50496 :252,169,001,145,251,238,096
50502 :082,003,173,082,003,205,106
50508 :107,003,240,003,076,184,177
50514 :196,096,141,079,003,152,237
50520 :056,233,004,141,080,003,093
50526 :162,000,173,080,003,208,208
50532 :007,173,079,003,201,040,091
50538 :144,021,173,079,003,056,070
50544 :233,040,141,079,003,173,013
50550 :080,003,233,000,141,080,143
50556 :003,232,076,096,197,096,056
50562 :032,229,192,169,032,160,176
50568 :200,153,039,004,136,208,108
50574 :250,056,173,062,003,237,155
50580 :114,003,141,079,003,173,149
50586 :063,003,237,115,003,013,076
50592 :079,003,144,012,173,062,121
50598 :003,141,114,003,173,063,151
50604 :003,141,115,003,169,001,092
50610 :141,113,003,169,000,141,233
50616 :032,208,141,033,208,141,179
50622 :008,212,160,008,185,011,006
50628 :198,153,055,004,136,016,246
50634 :247,160,014,185,020,198,002
50640 :153,132,004,136,016,247,128
50646 :160,009,185,060,198,153,211
50652 :211,004,136,016,247,173,239
50658 :114,003,141,071,003,173,219
50664 :115,003,141,072,003,169,223
50670 :220,141,064,003,032,151,081
50676 :193,173,000,220,041,016,119
50682 :208,008,173,113,003,208,195
50688 :244,076,023,192,169,000,192
50694 :141,113,003,240,234,007,232
50700 :001,013,005,032,015,022,100
50706 :005,018,032,016,018,005,112
50712 :019,019,032,020,018,009,141
50718 :007,007,005,018,032,030,129
50724 :032,004,018,015,009,004,118
50730 :019,005,001,019,025,060,171
50736 :032,062,008,001,018,004,173
50742 :022,032,017,021,009,020,175
50748 :032,008,009,032,019,003,163
50754 :015,018,005,032,003,008,147
50760 :015,013,016,005,018,020,159
50766 :009,013,005,032,032,032,201
50772 :032,032,032,032,032,032,020
50778 :032,032,042,005,024,042,011
50784 :025,015,021,032,001,018,208
50790 :005,032,015,014,005,032,205
50796 :015,006,032,020,008,005,194
50802 :032,006,005,023,032,020,232
50808 :015,032,023,009,014,032,245
50814 :001,020,032,003,008,015,205
50820 :013,016,005,018,032,029,245
50826 :196,169,000,160,150,153,198
50832 :063,003,136,208,250,032,068
50838 :229,192,160,006,185,070,224
50844 :198,153,200,005,136,016,096
50850 :247,160,014,185,020,198,218
50856 :153,020,006,136,016,247,234
50862 :173,000,220,041,016,208,064
50868 :249,096,169,147,032,210,059
50874 :255,032,229,192,160,039,069
50880 :185,096,198,153,184,005,245
50886 :136,016,247,076,130,197,232
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Kablam!

Article on page 60.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Kablam!—64 Version

```
100 FORX=24573TO24593:CS=CS+PEEK(X):NEXT:
    IFCS=2907THEN160                    :rem 5
110 PRINT"{CLR}{5 DOWN}READING IN:"
                                        :rem 22
120 PRINT"ML ROUTINE";:FORX=24573TO25219:
    READA:POKEX,A:B=B+A:NEXT      :rem 100
130 IFB<>72932THENPRINT" ERROR IN DATA":E
    ND                                  :rem 50
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140 PRINT" OK":PRINT"CHARACTERS":FORX=102
    40TO10575:READA:POKEX,A:NEXT :rem 123
150 PRINT"SPRITES":FORX=12800TO13056:READ
    A:POKEX,A:NEXT                :rem 34
160 POKE53281,1                   :rem 38
170 GOTO460 :REM GOTO TITLE PAGE  :rem 97
180 POKE53272,27:PRINT"{CLR}{5}{DOWN}";CH
    R$(8):POKE53280,7             :rem 58
190 PRINTTAB(30)"{RED}{DOWN}'$$$$$$$$$"
                                  :rem 142
200 PRINTTAB(30)"{UP}#KKKKKKKKK"  :rem 69
210 FORX=0TO1:PRINTTAB(30)"{UP}#KKKKKKKKK
    "                             :rem 0
220 PRINTTAB(30)"{UP}#KKMRVRNKK" :rem 101
230 PRINTTAB(30)"{UP}#KKX&%&WKK" :rem 241
240 PRINTTAB(30)"{UP}#KKPTUTOKK" :rem 110
250 PRINTTAB(30)"{UP}#KKKKKKKKK"  :rem 74
260 PRINTTAB(30)"{UP}#KKMRVRNKK" :rem 105
270 PRINTTAB(30)"{UP}#KKX&%&WKK" :rem 245
280 PRINTTAB(30)"{UP}#KKPTUTOKK" :rem 114
290 PRINTTAB(30)"{UP}#KKKKKKKKK":NEXT
                                  :rem 199
300 PRINTTAB(30)"{UP}#{8}JJJJJJJJJ{HOME}"
                                  :rem 235
310 PRINT"{HOME}{5 DOWN}{7}LLLLLLLLLLLLLL
    LLLLLLLLLLLLLLL"              :rem 79
320 PRINT"{HOME}"TAB(13)"YZ[£]!@@@@@@@@
    {DOWN}"SPC(5)"(←)]Y!C"        :rem 124
330 POKEV+21,31                   :rem 57
340 POKEV,128:POKEV+1,226:POKEV+2,20:POKE
    V+3,69:POKEV+4,30:POKEV+5,69  :rem 141
350 POKE830,1:POKE832,255:POKEV+30,0
                                  :rem 54
360 SYS24573                      :rem 157
370 A1=210:A2=30:A3=40:A4=215:A5=190:POKE
    V+21,26                       :rem 100
380 POKE24838,2:FORQ=1TO10        :rem 21
390 POKEV+8,INT(RND(1)*A1)+A2:POKEV+9,INT
    (RND(1)*A1)+A3                :rem 184
400 POKEV+6,INT(RND(1)*A4)+A2:POKEV+7,INT
    (RND(1)*A5)+A3                :rem 179
410 SYS24897:NEXT                 :rem 27
420 FORX=VTOV+9:POKEX,0:NEXT:POKEV+21,0
                                  :rem 4
430 FORI=1TO2000:NEXT:PRINT"{CLR}":POKE53
    272,21                        :rem 172
440 PRINT"{HOME}{12 DOWN}"TAB(15)"GAME OV
    ER":FORI=1TO2000:NEXT:GOTO160 :rem 48
450 REM TITLE PAGE                :rem 28
460 V=53248:S=2040:SI=54272:PRINT"{CLR}
    {BLU}":POKE53280,7            :rem 101
470 POKEV+39,9:POKEV+40,12:POKEV+41,0:POK
    EV+29,26:POKEV+43,8:POKEV+42,15
                                  :rem 36
480 POKES,200:POKES+1,202:POKES+2,201:POK
    ES+4,203:POKES+3,203          :rem 67
490 POKEV+21,12:POKEV+23,8:POKESI+24,15
                                  :rem 26
500 POKEV+4,160:POKEV+5,50:POKESI+6,240
                                  :rem 20
510 FORK=50TO130:POKEV+5,K:POKESI+1,255-K
    :POKESI,100:POKESI+4,17:NEXT  :rem 11
520 POKESI+1,0:POKESI,0:POKESI+4,0:rem 59
530 POKEV+21,8:POKEV+6,153:POKEV+7,122
                                  :rem 214
540 POKE24838,255:SYS24897:OPEN1,0
                                  :rem 217
550 PRINT"{CLR}{14 DOWN}"         :rem 236
560 PRINT"{DOWN}"TAB(8)"{8}ENTER SKILL LE
    VEL(1-15){2 RIGHT}";          :rem 187
570 INPUT#1,SL$:PRINT:SL=VAL(SL$):IFSL>15
    ORSL<1THEN550                 :rem 197
580 POKE53281,1:CLOSE1:SK=ABS(SL-16)*15+1
    5:POKE24838,SK                :rem 217
590 POKEV+6,0:POKEV+7,0:POKEV+23,0:POKEV+
    42,8                          :rem 188
600 GOTO180                       :rem 104
610 REM **** MACHINE LANGUAGE DATA ****
                                  :rem 30
620 DATA 162,0,169,10,157,192,7   :rem 244
630 DATA 169,0,157,192,219,232,224
                                  :rem 143
640 DATA 40,208,241,120,169,98,141
                                  :rem 139
650 DATA 21,3,169,66,141,20,3     :rem 138
660 DATA 88,32,149,97,76,168,96    :rem 28
670 DATA 169,0,170,168,24,109,167:rem 100
680 DATA 2,144,1,200,202,208,247   :rem 25
690 DATA 152,73,255,141,0,208,173 :rem 90
700 DATA 30,208,41,5,201,5,240    :rem 174
710 DATA 3,76,97,96,172,3,208     :rem 160
720 DATA 140,5,208,174,2,208,232  :rem 30
730 DATA 232,232,232,232,232,232,232
                                  :rem 221
740 DATA 232,232,142,4,208,32,162 :rem 78
750 DATA 97,169,255,141,64,3,76   :rem 10
760 DATA 97,96,165,197,201,60,240:rem 106
770 DATA 3,76,49,234,169,0,141    :rem 204
780 DATA 24,212,173,1,220,201,251 :rem 71
790 DATA 240,2,208,247,169,15,141 :rem 93
800 DATA 24,212,76,49,234,165,251 :rem 92
810 DATA 240,18,174,2,208,169,1   :rem 243
820 DATA 133,251,232,224,225,240,6
                                  :rem 127
830 DATA 142,2,208,76,190,96,174   :rem 50
840 DATA 2,208,169,0,133,251,202   :rem 29
850 DATA 224,17,240,226,142,2,208 :rem 82
860 DATA 76,190,96,172,3,208,140   :rem 50
870 DATA 5,208,174,2,208,232,232   :rem 38
880 DATA 232,232,232,232,232,232,232
                                  :rem 227
890 DATA 232,142,4,208,172,5,208   :rem 40
900 DATA 200,192,223,240,12,140,5 :rem 67
910 DATA 208,32,255,96,32,39,97     :rem 7
920 DATA 76,128,96,120,173,77,4     :rem 4
930 DATA 240,35,206,77,4,174,4    :rem 198
940 DATA 208,142,8,208,162,0,142   :rem 34
950 DATA 4,208,172,5,208,140,9     :rem 197
960 DATA 208,32,65,97,169,255,141:rem 109
970 DATA 9,208,141,64,3,88,76      :rem 165
980 DATA 168,96,234,76,43,98,173   :rem 74
990 DATA 62,3,141,60,3,169,235    :rem 200
1000 DATA 141,61,3,206,61,3,208   :rem 223
1010 DATA 251,206,60,3,208,241,169
                                  :rem 126
1020 DATA 5,141,62,3,169,64,141   :rem 235
1030 DATA 96,3,206,96,3,173,96    :rem 204
1040 DATA 3,208,245,96,162,32,142 :rem 83
1050 DATA 6,212,174,64,3,202,142   :rem 23
1060 DATA 64,3,142,1,212,162,10   :rem 221
1070 DATA 142,0,212,162,17,142,4   :rem 18
1080 DATA 212,96,32,149,97,169,240
                                  :rem 152
1090 DATA 141,13,212,162,4,169,8   :rem 32
1100 DATA 141,8,212,169,100,141,7 :rem 69
1110 DATA 212,169,129,141,11,212,160
                                  :rem 218
1120 DATA 15,140,62,3,32,255,96   :rem 236
1130 DATA 169,4,141,8,212,169,129 :rem 90
1140 DATA 141,11,212,202,208,220,169
                                  :rem 215
1150 DATA 5,141,8,212,169,129,141 :rem 83
1160 DATA 11,212,160,160,140,62,3 :rem 63
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1170 DATA 32,255,96,162,200,142,13
                                    :rem 129
1180 DATA 212,169,2,141,62,3,32     :rem 233
1190 DATA 255,96,202,208,242,32,149
                                    :rem 193
1200 DATA 97,96,162,0,232,169,0     :rem 244
1210 DATA 157,0,212,224,22,208,246
                                    :rem 122
1220 DATA 96,173,24,4,201,9,240     :rem 237
1230 DATA 4,238,24,4,96,173,23      :rem 194
1240 DATA 4,201,9,240,24,169,0      :rem 181
1250 DATA 141,24,4,238,23,4,206     :rem 232
1260 DATA 6,97,206,6,97,206,6       :rem 157
1270 DATA 97,206,6,97,206,6,97      :rem 216
1280 DATA 96,173,22,4,201,9,240     :rem 241
1290 DATA 12,169,0,141,23,4,141     :rem 230
1300 DATA 24,4,238,22,4,96,173      :rem 191
1310 DATA 21,4,201,9,240,12,169     :rem 227
1320 DATA 0,141,22,4,141,23,4       :rem 117
1330 DATA 238,21,4,96,173,20,4      :rem 189
1340 DATA 201,9,240,15,169,0,141     :rem 24
1350 DATA 21,4,8,49,4,141,23         :rem 86
1360 DATA 4,238,20,4,96,173,19      :rem 199
1370 DATA 4,201,9,240,15,169,0      :rem 185
1380 DATA 141,20,4,141,21,4,141     :rem 221
1390 DATA 22,4,238,19,4,96,162      :rem 202
1400 DATA 0,169,0,157,19,4,232      :rem 185
1410 DATA 224,7,208,248,96,120,169
                                    :rem 145
1420 DATA 234,141,21,3,169,49,141   :rem 81
1430 DATA 20,3,88,173,21,208,41     :rem 236
1440 DATA 18,141,21,208,76,149,97   :rem 98
1450 DATA 72,152,72,138,72,173,0    :rem 38
1460 DATA 220,41,4,208,11,173,167   :rem 79
1470 DATA 2,173,167,2,105,4,141     :rem 235
1480 DATA 167,2,173,0,220,41,8      :rem 187
1490 DATA 208,9,56,173,167,2,233     :rem 49
1500 DATA 4,141,167,2,104,170,104   :rem 68
1510 DATA 168,104,76,35,96,0,0      :rem 193
1520 DATA 0,2,0,0,0,46,0            :rem 118
1530 DATA 0,0,0,0,128,0,119          :rem 17
1540 DATA 20,255,227                :rem 213
1550 REM ******* CHARACTER DATA *******
                                    :rem 162
1560 DATA 126,102,102,230,230,230,254,0,2
     4,24,24,56,56,56,56,0,254      :rem 152
1570 DATA 198,6,254,224,224,254,0,254,6,6
     ,62,14,14,254,0,198,198        :rem 93
1580 DATA 198,254,14,14,14,0,254,192,192,
     254,14,206,254,0,254,198       :rem 139
1590 DATA 192,254,230,230,254,0,254,198,1
     2,24,56,56,56,0,126,102        :rem 76
1600 DATA 102,254,230,230,254,0,254,198,1
     98,254,14,206,254,0,255        :rem 74
1610 DATA 255,255,255,255,255,255,255,239
     ,239,239,0,127,127,127,0       :rem 150
1620 DATA 255,66,36,24,24,36,66,255,255,2
     55,192,192,192,192,192          :rem 61
1630 DATA 192,255,255,3,3,3,3,3,3,3,3,3,3
     ,3,3,255,255,192,192,192       :rem 108
1640 DATA 192,192,192,255,255,192,192,192
     ,192,192,192,192,192           :rem 225
1650 DATA 255,255,0,0,0,0,0,0,3,3,3,3,3,3
     ,3,3,0,0,0,0,0,0,0,255          :rem 90
1660 DATA 255,24,24,24,24,24,24,255,255,2
     55,255,24,24,24,24,24          :rem 233
1670 DATA 24,3,3,3,255,255,3,3,3,192,192,
     192,255,255,192,192            :rem 144
1680 DATA 192,0,60,102,48,12,102,60,0,0,6
     0,102,96,96,102,60,0           :rem 150
1690 DATA 0,60,102,102,102,102,60,0,0,124
     ,102,102,124,102,102,0         :rem 208
1700 DATA 0,126,96,120,96,96,126,0,0,102,
     102,126,102,102,102,0,0        :rem 28
1710 DATA 126,24,24,24,24,126,0,0,0,0,0,0
     ,0,0,0,0,24,24,0,0,24          :rem 143
1720 DATA 24,0,102,102,102,102,0,0,0,0,22
     0,222,220,216,220,222          :rem 155
1730 DATA 220,216,255,255,0,255,255,119,3
     4,0,24,24,24,255,255           :rem 182
1740 DATA 24,24,24,0,0,0,255,255,0,0,0,25
     5,255,192,223,222,220          :rem 197
1750 DATA 216,216,0,96,96,96,96,96,124,0,
     0,102,102,102,102,60,24,0      :rem 159
1760 ******* SPRITE DATA *******     :rem 11
1770 DATA 0,0,0,0,0,0,3,128,7,3,192,15,3,
     255,255,3,255,255,1            :rem 98
1780 DATA 255,254,1,255,254,0,255,252,0,2
     55,252,0,255,252,0,127         :rem 22
1790 DATA 248,0,127,248,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,0,0,0,0         :rem 165
1800 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,128,0
     ,4,32,0,1,128,0,3,8,0,6        :rem 212
1810 DATA 32,0,6,0,0,15,0,0,15,0,0,63,192
     ,0,255,240,1,255,248,3         :rem 228
1820 DATA 255,252,3,255,252,3,255,252,3,2
     55,252,1,255,248,0              :rem 85
1830 DATA 255,240,0,127,224,0,31,128,0,0,
     127,0,0,255,128,0,65           :rem 149
1840 DATA 0,0,148,128,0,128,128,0,93,0,0,
     34,0,0,28,0,1,255              :rem 251
1850 DATA 128,6,8,96,8,0,16,8,201,16,9,0,
     144,8,129,48,4,129              :rem 95
1860 DATA 32,4,129,32,3,195,192,1,231,128
     ,2,195,64,2,0,64,1              :rem 75
1870 DATA 255,128,0,16,8,8,58,28,92,111,5
     4,246,195,99,227,1              :rem 115
1880 DATA 128,0,0,0,0,164,200,149,164,168
     ,149,170,169,93,202            :rem 137
1890 DATA 201,93,206,169,213,170,169,85,1
     70,169,84,170,205,85           :rem 218
1900 DATA 0,0,0,0,0,0,192,236,3,98,187,6,
     55,147,116,29,1,220            :rem 111
1910 DATA 8,0,136,0,0               :rem 247
```

Program 2: Kablam!—VIC Version

See special instructions in article before typing in.

```
6291 :011,016,000,000,158,052,128
6297 :049,048,057,000,000,000,051
6303 :169,000,141,092,003,141,193
6309 :093,003,169,024,141,015,098
6315 :144,032,130,020,032,100,117
6321 :016,032,012,018,032,074,105
6327 :017,169,007,141,074,003,082
6333 :169,003,141,064,003,173,230
6339 :076,003,016,024,032,235,069
6345 :017,172,074,003,196,251,146
6351 :208,003,076,077,016,032,107
6357 :055,019,032,030,019,169,025
6363 :010,141,076,003,206,076,219
6369 :003,032,140,017,032,131,068
6375 :016,032,078,019,032,219,115
6381 :019,173,072,003,208,207,151
6387 :076,245,018,169,000,141,124
6393 :060,003,141,061,003,141,146
6399 :074,003,141,108,021,141,231
6405 :064,003,032,074,017,169,108
6411 :003,141,072,003,169,010,153
6417 :141,076,003,096,169,239,229
6423 :141,019,145,173,017,145,151
```

```
6429 :041,016,208,003,206,108,099
6435 :021,169,127,141,034,145,160
6441 :173,032,145,041,128,208,000
6447 :003,238,108,021,173,108,186
6453 :021,041,015,141,108,021,144
6459 :208,006,201,002,176,002,142
6465 :169,001,201,011,144,002,081
6471 :169,012,141,064,003,168,116
6477 :162,002,185,162,031,208,059
6483 :008,169,032,153,162,031,126
6489 :032,055,017,185,184,031,081
6495 :208,008,169,032,153,184,081
6501 :031,032,055,017,185,206,115
6507 :031,208,008,169,032,153,196
6513 :206,031,032,055,017,200,142
6519 :202,016,213,172,064,003,021
6525 :196,252,240,071,164,252,020
6531 :169,032,162,003,153,184,066
6537 :031,153,206,031,200,202,192
6543 :016,246,172,064,003,169,045
6549 :027,153,184,031,153,206,135
6555 :031,132,252,169,000,153,124
6561 :184,151,153,206,151,200,182
6567 :169,028,153,184,031,153,117
6573 :206,031,169,000,153,184,148
6579 :151,153,206,151,200,169,185
6585 :029,153,184,031,153,206,173
6591 :031,169,000,153,184,151,111
6597 :153,206,151,096,173,082,034
6603 :003,240,003,206,082,003,228
6609 :238,060,003,173,060,003,234
6615 :208,003,238,061,003,162,122
6621 :004,160,016,024,032,240,185
6627 :255,174,060,003,173,061,185
6633 :003,032,205,221,056,173,155
6639 :060,003,237,092,003,133,255
6645 :170,173,061,003,237,093,214
6651 :003,005,170,144,012,173,246
6657 :060,003,141,092,003,173,217
6663 :061,003,141,093,003,162,214
6669 :008,160,016,024,032,240,237
6675 :255,174,092,003,173,093,041
6681 :003,032,205,221,096,169,239
6687 :206,133,167,169,031,133,102
6693 :168,173,141,002,208,251,212
6699 :169,228,133,170,169,031,175
6705 :133,171,169,228,133,180,039
6711 :169,151,133,181,162,021,104
6717 :160,021,177,167,208,012,038
6723 :072,169,032,145,167,104,244
6729 :145,170,169,000,145,180,114
6735 :136,016,237,056,165,167,088
6741 :233,022,133,167,165,168,205
6747 :233,000,133,168,056,165,078
6753 :170,233,022,133,170,165,222
6759 :171,233,000,133,171,056,099
6765 :165,180,233,022,133,180,254
6771 :165,181,233,000,133,181,240
6777 :202,016,193,096,032,148,040
6783 :224,165,142,162,003,010,065
6789 :202,208,252,024,101,142,038
6795 :010,101,142,105,003,133,121
6801 :142,074,074,056,233,012,224
6807 :176,252,105,015,133,251,059
6813 :096,169,128,141,019,145,087
6819 :169,255,141,034,145,169,052
6825 :147,032,210,255,162,011,218
6831 :160,005,024,032,240,255,123
6837 :160,000,185,244,019,032,053
6843 :210,255,200,192,012,208,240
6849 :245,169,014,032,210,255,094
6855 :162,013,160,005,024,032,083
6861 :240,255,160,000,185,000,021
6867 :020,032,210,255,200,192,096
6873 :012,208,245,032,228,255,173
6879 :240,251,201,049,144,247,075
6885 :201,054,176,243,056,233,168
6891 :048,073,255,141,063,003,050
6897 :169,147,032,210,255,032,062
6903 :202,020,174,063,003,024,221
6909 :169,000,105,048,202,208,217
6915 :251,141,082,003,162,003,133
6921 :160,016,024,032,240,255,224
6927 :160,000,185,062,020,032,218
6933 :210,255,200,192,007,208,069
6939 :245,162,006,160,016,024,128
6945 :032,240,255,160,000,185,137
6951 :069,020,032,210,255,200,057
6957 :192,012,208,245,162,010,106
6963 :160,016,024,032,240,255,010
6969 :160,000,185,081,020,032,023
6975 :210,255,200,192,007,208,111
6981 :245,162,013,160,016,024,177
6987 :032,240,255,160,000,185,179
6993 :088,020,032,210,255,200,118
6999 :192,015,208,245,162,022,163
7005 :160,001,024,032,240,255,037
7011 :160,000,185,111,020,032,095
7017 :210,255,200,192,019,208,165
7023 :245,169,000,141,019,145,062
7029 :173,017,145,041,032,208,221
7035 :249,160,021,169,032,153,139
7041 :228,031,136,208,248,096,052
7047 :160,002,162,022,024,032,025
7053 :240,255,160,000,185,012,225
7059 :020,032,210,255,200,192,032
7065 :018,208,245,032,228,255,115
7071 :240,251,201,089,240,007,163
7077 :201,078,240,006,076,010,008
7083 :019,076,029,016,000,164,219
7089 :251,140,074,003,162,001,040
7095 :024,032,240,255,160,000,126
7101 :185,030,020,032,210,255,153
7107 :200,192,017,208,245,096,129
7113 :172,074,003,162,001,024,125
7119 :032,240,255,160,000,185,055
7125 :047,020,032,210,255,200,209
7131 :192,014,208,245,096,160,110
7137 :021,185,228,031,208,028,158
7143 :169,036,153,228,031,169,249
7149 :000,153,228,151,072,152,225
7155 :072,032,182,019,032,219,031
7161 :019,104,168,104,206,072,154
7167 :003,076,116,019,136,208,045
7173 :220,169,032,153,228,031,070
7179 :162,011,160,016,024,032,160
7185 :240,255,173,082,003,205,207
7191 :084,003,240,013,160,000,011
7197 :185,103,020,032,210,255,066
7203 :200,192,008,208,245,173,037
7209 :082,003,141,084,003,056,154
7215 :073,255,170,169,000,032,234
7221 :205,221,162,015,160,016,064
7227 :024,032,240,255,174,072,088
7233 :003,169,000,032,205,221,183
7239 :096,169,015,141,014,144,138
7245 :169,129,141,013,144,162,067
7251 :010,138,072,032,219,019,061
7257 :104,170,202,208,246,169,164
7263 :000,141,014,144,024,173,079
```

```
7269 :082,003,105,016,141,082,018
7275 :003,096,172,082,003,162,113
7281 :080,202,208,253,136,192,160
7287 :255,208,246,056,173,013,046
7293 :144,233,012,009,128,141,024
7299 :013,144,096,144,032,032,080
7305 :075,065,066,076,065,077,049
7311 :032,032,032,076,069,086,214
7317 :069,076,032,040,049,045,204
7323 :053,041,063,080,076,065,021
7329 :089,032,065,071,065,073,044
7335 :078,032,089,032,079,082,047
7341 :032,078,063,031,032,157,054
7347 :017,094,095,157,157,017,204
7353 :033,035,017,157,157,144,216
7359 :017,064,144,032,157,017,110
7365 :032,032,157,157,017,032,112
7371 :032,017,157,157,017,028,099
7377 :083,067,079,082,069,144,221
7383 :030,072,073,017,157,157,209
7389 :083,067,079,082,069,144,233
7395 :156,083,080,069,069,068,240
7401 :144,066,079,077,066,083,236
7407 :017,157,157,157,157,157,017
7413 :076,069,070,084,032,032,096
7419 :032,032,157,157,157,157,175
7425 :080,082,069,083,083,032,174
7431 :070,073,082,069,032,084,161
7437 :079,032,083,084,065,082,182
7443 :084,160,000,185,000,128,064
7449 :153,000,028,200,208,247,093
7455 :160,000,185,000,129,153,146
7461 :000,029,200,208,247,160,113
7467 :007,185,020,021,153,000,173
7473 :028,136,016,247,160,039,163
7479 :185,028,021,153,216,028,174
7485 :136,016,247,160,007,185,044
7491 :068,021,153,008,029,136,226
7497 :016,247,160,031,185,076,020
7503 :021,153,024,029,136,016,202
7509 :247,169,255,141,005,144,022
7515 :096,162,021,169,059,133,219
7521 :167,169,030,133,168,160,156
7527 :006,169,037,145,167,024,139
7533 :165,168,105,120,133,168,200
7539 :169,002,145,167,056,165,051
7545 :168,233,120,133,168,136,055
7551 :208,231,024,165,167,105,003
7557 :022,133,167,165,168,105,125
7563 :000,133,168,202,208,213,039
7569 :160,015,169,038,153,088,000
7575 :030,136,016,248,160,015,244
7581 :169,002,153,088,150,136,087
7587 :016,248,096,048,008,008,075
7593 :060,126,126,126,060,255,154
7599 :255,255,063,031,015,007,033
7605 :003,255,255,255,255,255,179
7611 :255,255,255,255,255,255,181
7617 :252,248,240,224,192,015,084
7623 :018,016,010,005,060,064,116
7629 :072,240,072,008,080,160,069
7635 :056,004,036,072,072,072,011
7641 :072,119,064,064,063,036,123
7647 :036,036,036,220,004,004,047
7653 :248,200,084,156,212,051,156
7659 :043,048,035,238,238,238,051
7665 :000,187,187,187,000,255,033
7671 :065,036,024,024,036,065,241
7677 :255,058,013,013,013,013,106
```

Disk Merge

Article on page 135.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 GOTO390                                   :rem 102
110 GET#FI,BY$:IFBY$<>""THENPRINT#3,BY$;:
    GOTO110                                   :rem 146
120 PRINT#3,NU$;:RETURN                       :rem 190
130 GET#FI,BY$:IFBY$=""THENBY=0:RETURN
                                              :rem 107
140 BY=ASC(BY$):RETURN                        :rem 110
150 DV=WD/256:HI=INT(DV):LO=WD-HI*256:PRI
    NT#3,CHR$(LO);CHR$(HI);:RETURN
                                              :rem 141
160 GOSUB130:LO=BY:GOSUB130:LI(FI)=BY*256
    +LO                                       :rem 186
170 GOSUB130:LO=BY:GOSUB130:LN(FI)=BY*256
    +LO                                       :rem 192
180 IFLI(FI)>0THENPRINTTAB((FI-1)*9);LN(F
    I);"{UP}"                                 :rem 85
190 CA(FI)=CA(FI)+LS(FI):LS(FI)=LI(FI)-CA
    (FI):RETURN                               :rem 95
200 LI(3)=LI(3)+LS(FI):WD=LI(3):GOSUB150:
    WD=LN(FI):GOTO150                         :rem 187
210 GOSUB200:GOSUB110:GOTO160                 :rem 251
220 IFLI(1)=0ANDLI(2)=0THENRETURN              :rem 14
230 IFLI(2)=0THENFI=1:GOSUB210:GOTO220
                                              :rem 41
240 IFLI(1)=0THENFI=2:GOSUB210:GOTO220
                                              :rem 42
250 IFLN(1)<LN(2)THENFI=1:GOSUB210:GOTO22
    0                                         :rem 27
260 IFLN(1)>LN(2)THENFI=2:GOSUB210:GOTO22
    0                                         :rem 31
270 FI=1:GOSUB210:FI=2:GOSUB280:GOTO220
                                              :rem 118
280 GET#FI,BY$:IFBY$<>""THEN280               :rem 38
290 GOTO160                                   :rem 107
300 GOSUB130:LO=BY:GOSUB130:CA(FI)=BY*256
    +LO:RETURN                                :rem 191
310 WD=CA(3):GOTO150                          :rem 125
320 PRINT PROMPT$;"{5 SHIFT-SPACE}
    {5 LEFT}";                                :rem 19
330 INPUT FI$:FC$=LEFT$(FI$,1)                :rem 173
340 NULL=FC$="{SHIFT-SPACE}":QUIT=FC$="*"
    :RETURN                                   :rem 9
350 OPEN FI,8,FI+2,"0:"+FI$                   :rem 141
360 INPUT#15,EN,EM$,ET,ES                     :rem 220
370 ERR=EN>19:IF ERR THEN PRINT EN;EM$:CL
    OSE FI                                    :rem 44
380 RETURN                                    :rem 123
390 DIM CA(3),LI(3),LN(2),LS(2)               :rem 90
400 NU$=CHR$(0)                               :rem 26
410 PRINT:PRINT "{RVS}{5 SPACES}DISK MERG
    E{5 SPACES}"                              :rem 218
420 OPEN 15,8,15                              :rem 36
430 FI=1:PROMPT$="{2 SPACES}PRIMARY FILE"
                                              :rem 153
440 GOSUB 320:IF NULL THEN 440                :rem 120
450 IF QUIT THEN 700                          :rem 49
460 GOSUB 350:IF ERR THEN 440                 :rem 43
470 FI=2:PROMPT$="SECONDARY FILE"             :rem 34
```

```
480 GOSUB 320:SECNULL=NULL        :rem 121
490 IF SECNULL THEN PRINT "*RELOCATE ONLY
    *":GOTO530                    :rem 50
500 IF QUIT THEN 700              :rem 45
510 AF$=FI$                       :rem 49
520 GOSUB 350:IF ERR THEN 480     :rem 44
530 FI=3:PROMPT$="{3 SPACES}MERGED FILE"
                                  :rem 44
540 GOSUB 320:IF NULL THEN 540    :rem 122
550 IF QUIT THEN 700              :rem 50
560 FI$=FI$+",P,W":GOSUB 350:IF ERR=0 THE
    N 620                         :rem 228
570 IF EN<>70 THEN 540            :rem 103
580 PRINT "{UP}{16 SPACES}{UP}"   :rem 144
590 BF$=FI$:CLOSE 2:GOSUB 350:E2=ERR
                                  :rem 69
600 FI=2:FI$=AF$:GOSUB350:FI=3:FI$=BF$
                                  :rem 202
610 IF E2 THEN 530                :rem 100
620 INPUT"{2 SPACES}BASE ADDRESS
    {2 SPACES}1025{6 LEFT}";BASE$:rem 125
630 IF LEFT$(BASE$,1)="*" THEN 700
                                  :rem 213
640 CA(3)=VAL(BASE$):LI(3)=CA(3)  :rem 234
650 FI=1:GOSUB 300:GOSUB 160      :rem 54
660 IF NOT SECNULL THEN FI=2:GOSUB 300:GO
    SUB 160                       :rem 253
670 GOSUB 310                     :rem 177
680 GOSUB 220                     :rem 178
690 PRINT#3,NU$;NU$;              :rem 178
700 CLOSE 3:CLOSE 2:CLOSE 1:CLOSE 15
                                  :rem 25
710 END                           :rem 111
```

Tiny MLX

Article on page 145.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 POKE56,24:POKE55,146:CLR:POKE788,194
                                  :rem 76
210 S=6291:E=7682                 :rem 136
300 PRINT"{CLR}";CHR$(14):AD=S    :rem 56
310 PRINTRIGHT$("0000"+MID$(STR$(AD),2),5
    );":";:FORJ=1TO6              :rem 234
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                  :rem 228
480 IFN<0THENPRINT:GOTO310        :rem 168
490 A(J)=N:NEXTJ                  :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT   :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(20)
                                  :rem 234
515 IFN=CKSUMTHEN530              :rem 255
520 PRINT:PRINT"LINE ENTERED WRONG":PRINT
    "RE-ENTER":PRINT:GOSUB1000:GOTO310
                                  :rem 129
530 GOSUB2000                     :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:rem 80
550 AD=AD+6:IFAD<ETHEN310         :rem 212
560 GOTO710                       :rem 108
570 N=0:Z=0                       :rem 88
580 PRINT"{+}";                   :rem 79
581 GETA$:IFA$=""THEN581          :rem 95
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670                 :rem 229
590 IFA>128THENN=-A:RETURN        :rem 137
600 IFA<>20 THEN 630              :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {LEFT} {LEFT}";:GOTO690       :rem 172
620 GOTO570                       :rem 109
630 IFA<48ORA>57THEN580           :rem 105
640 PRINTA$;:N=N*10+A-48          :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                  :rem 229
660 Z=Z+1:IFZ<3THEN580            :rem 71
670 IFZ=0THENGOSUB1000:GOTO570    :rem 114
680 PRINT",";:RETURN              :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                  :rem 149
692 FORI=1TO3:T=PEEK(S%-I)        :rem 68
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                  :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                  :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                  :rem 236
720 INPUT"{DOWN} FILENAME";F$     :rem 228
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"        :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                  :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                  :rem 158
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256              :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                  :rem 109
763 POKE780,1:POKE781,DV:POKE782,0:SYS654
    66                            :rem 68
765 POKE254,S/256:POKE253,S-PEEK(254)*256
    :POKE780,253                  :rem 12
766 POKE782,E/256:POKE781,E-PEEK(782)*256
    :SYS65496                     :rem 124
770 IF(PEEK(783)AND1)OR(ST AND191)THEN780
                                  :rem 111
775 PRINT"{DOWN}DONE.":END        :rem 106
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720      :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO720          :rem 103
782 GOTO720                       :rem 115
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                            :rem 70
1000 REM BELL TONE                :rem 250
1001 POKE36878,15:POKE36874,190   :rem 206
1002 FORW=1TO300:NEXTW            :rem 117
1003 POKE36878,0:POKE36874,0:RETURN
                                  :rem 74
2000 REM BELL SOUND               :rem 78
2001 FORW=15TO0STEP-1:POKE36878,W:POKE368
     76,240:NEXTW                 :rem 22
2002 POKE36876,0:RETURN           :rem 119
```

MLX For The 64

```
10 REM LINES CHANGED FROM MLX VERSION 2.0
   0 ARE 750,765,770 AND 860      :rem 50
20 REM LINE CHANGED FROM MLX VERSION 2.01
    IS 300                        :rem 147
100 PRINT"{CLR}{63}";CHR$(142);CHR$(8);:PO
    KE53281,1:POKE53280,1         :rem 67
```

```
101 POKE 788,52:REM DISABLE RUN/STOP
                                    :rem 119
110 PRINT"{RVS}{39 SPACES}";        :rem 176
120 PRINT"{RVS}{14 SPACES}{RIGHT}{OFF}[*]
    £{RVS}{RIGHT} {RIGHT}{2 SPACES}[*]
    ]{OFF}[*]£{RVS}£{RVS}{14 SPACES}";
                                    :rem 250
130 PRINT"{RVS}{14 SPACES}{RIGHT} [G]
    {RIGHT} {2 RIGHT} {OFF}£{RVS}£[*]
    {OFF}[*]{RVS}{14 SPACES}";      :rem 35
140 PRINT"{RVS}{41 SPACES}"         :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} MACHINE LANG
    UAGE EDITOR VERSION 2.02{5 DOWN}"
                                    :rem 238
210 PRINT"[5]{2 UP}STARTING ADDRESS?
    {8 SPACES}{9 LEFT}";            :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F)
                                    :rem 166
220 IFS<2560R(S>40960ANDS<49152)ORS>53247
    THENGOSUB3000:GOTO210           :rem 235
225 PRINT:PRINT:PRINT               :rem 180
230 PRINT"[5]{2 UP}ENDING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=
    CHR$(31+119*F)                  :rem 20
240 IFE<2560R(E>40960ANDE<49152)ORE>53247
    THENGOSUB3000:GOTO230           :rem 183
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230
                                    :rem 176
260 PRINT:PRINT:PRINT               :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S      :rem 56
310 A=1:PRINTRIGHT$("0000"+MID$(STR$(AD),
    2),5);":";                      :rem 33
315 FORJ=ATO6                       :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                    :rem 228
390 IFN=-211THEN 710                :rem 62
400 IFN=-204THEN 790                :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER N
    EW ADDRESS";ZZ                  :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"
    {RVS}OUT OF RANGE":GOSUB1000:GOTO410
                                    :rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310
                                    :rem 238
420 IF N<>-196 THEN 480             :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
    ";:INPUTT                       :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
    T";S;"{LEFT}, NOT MORE THAN";E:GOTO43
    0                               :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("000
    0"+MID$(STR$(I),2),5);":";      :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00
    "+MID$(STR$(N),2),3);",";       :rem 66
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                    :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRIN
    T:GOTO310                       :rem 50
480 IFN<0 THEN PRINT:GOTO310        :rem 168
490 A(J)=N:NEXTJ                    :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT     :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(146
    );                              :rem 94
511 IFN=-1THENA=6:GOTO315           :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHEN530
                                    :rem 122
520 PRINT:PRINT"LINE ENTERED WRONG : RE-E
    NTER":PRINT:GOSUB1000:GOTO310:rem 176
530 GOSUB2000                       :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54
    272,0:POKE54273,0               :rem 227
550 AD=AD+6:IF AD<E THEN 310        :rem 212
560 GOTO 710                        :rem 108
570 N=0:Z=0                         :rem 88
580 PRINT"[£]";                     :rem 81
581 GETA$:IFA$=""THEN581            :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*(A$=".")-4*
    (A$="J")-5*(A$="K")-6*(A$="L"):rem 41
583 AV=AV-7*(A$="U")-8*(A$="I")-9*(A$="O"
    ):IFA$="H"THENA$="0"            :rem 134
584 IFAV>0THENA$=CHR$(48+AV)        :rem 134
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670                   :rem 229
590 IFA>128THENN=-A:RETURN          :rem 137
600 IFA<>20 THEN 630                :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {OFF}{LEFT} {LEFT}";:GOTO690    :rem 62
620 GOTO570                         :rem 109
630 IFA<48ORA>57THEN580             :rem 105
640 PRINTA$;:N=N*10+A-48            :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                    :rem 229
660 Z=Z+1:IFZ<3THEN580              :rem 71
670 IFZ=0THENGOSUB1000:GOTO570      :rem 114
680 PRINT",";:RETURN                :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                    :rem 149
691 FORI=1TO3:T=PEEK(S%-I)          :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                    :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                    :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                    :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
     ALONE TO CANCEL SAVE){DOWN}":rem 106
720 F$="":INPUT"{DOWN} FILENAME";F$:IFF$=
    ""THENPRINT:PRINT:GOTO310       :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"         :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                    :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$:
    OPEN15,8,15,"S"+F$:CLOSE15      :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                    :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                              :rem 69
765 K=S:POKE254,K/256:POKE253,K-PEEK(254)
    *256:POKE780,253                :rem 17
766 K=E+1:POKE782,K/256:POKE781,K-PEEK(78
    2)*256:SYS65496                 :rem 235
770 IF(PEEK(783)AND1)OR(191ANDST)THEN780
                                    :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":GOTO310
                                    :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720        :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO720            :rem 103
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                    :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
     ALONE TO CANCEL LOAD)"         :rem 82
800 F$="":INPUT"{2 DOWN} FILENAME";F$:IFF
    $=""THENPRINT:GOTO310           :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"         :rem 227
```

```
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
                                    :rem 34
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                    :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                :rem 2
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                    :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                              :rem 70
850 POKE780,0:SYS65493              :rem 11
860 IF(PEEK(783)AND1)OR(191ANDST)THEN870
                                    :rem 111
865 PRINT"{DOWN}DONE.":GOTO310      :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                    :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800            :rem 102
1000 REM BUZZER                     :rem 135
1001 POKE54296,15:POKE54277,45:POKE54278,
    165                             :rem 207
1002 POKE54276,33:POKE 54273,6:POKE54272,
    5                               :rem 42
1003 FORT=1TO200:NEXT:POKE54276,32:POKE54
    273,0:POKE54272,0:RETURN        :rem 202
2000 REM BELL SOUND                 :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,2
    47                              :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272
    ,0                              :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                    :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
    GOTO1000                        :rem 89
```

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COMPUTE!'s Gazette for Commodore

AUTHOR GUIDE

COMPUTE!'s Gazette for Commodore is looking for interesting, useful articles aimed at beginning to intermediate VIC-20 and Commodore 64 users. If you have an article idea or a good original program, we'd like to see it. Don't worry if you are not a professional writer. We are more concerned with the content of an article than its style. Simply try to be clear in your writing and check your program for any bugs.

COMPUTE!'s Gazette for Commodore is a consumer-oriented magazine for VIC-20 and Commodore 64 users who want to get the most out of their computers in a non-technical way. It is aimed primarily at home users, not all of whom necessarily want to become expert programmers. If your article covers a more advanced or technical topic, you may choose to submit it to our companion publication, **COMPUTE!**. If you submit an article to one of our magazines and we believe it would be more suitable to the other, we will transfer your submission to the right editors. The basic editorial requirements for publication are the same for both magazines; so are the payment rates.

The following guidelines will permit your good ideas and programs to be more easily edited and published. Most of these suggestions serve to improve the speed and accuracy of publication:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to either the VIC-20 or Commodore 64, please state which one. In addition, please indicate the memory requirements of programs.

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* The tape or disk should be labeled with your name and the title of the article. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

It is far easier for others to type in your program if you use CHR$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I=1 TO 5:PRINT:NEXT is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program – making these substitutions – would be greatly appreciated by your editors and by your readers.

6. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing "Revision" on the envelope and the article.

7. All lines within the text of the article should be spaced so that there is about 1/2 inch between them. A one-inch margin should be left at the right, left, top, and bottom of each page. No hyphens should be used at the ends of lines to break words. And please do not justify. Leave the lines ragged.

8. Standard typing paper should be used (no onionskin or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

9. Sheets should be attached together with a paper clip. Staples should not be used.

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. *COMPUTE!'s Gazette* for Commodore pays between $75 and $1000 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance of an article. Following submission (Editorial Department, *COMPUTE!'s Gazette* for Commodore, P.O. Box 5406, Greensboro, NC 27403) it will take from four to six weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. Rejected manuscripts are returned to authors who enclose an SASE. We do not consider articles which are multiple submissions. If you wish to send an article to another magazine for consideration, please do not submit it to us.

13. Articles can be of any length – from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

14. If you want to include photographs, they should be 5x7, black-and-white glossies.

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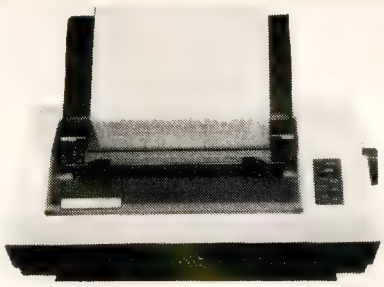

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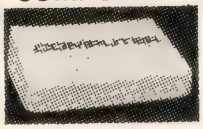

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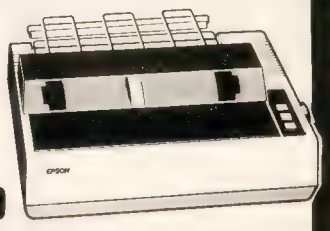

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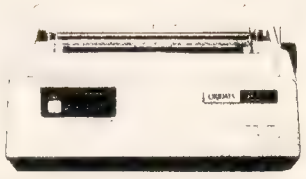

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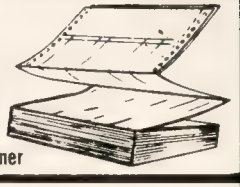

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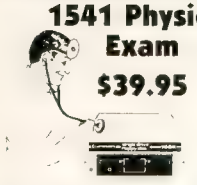

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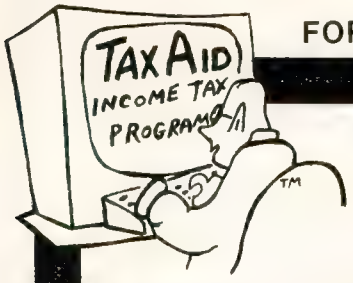

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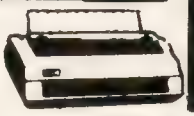

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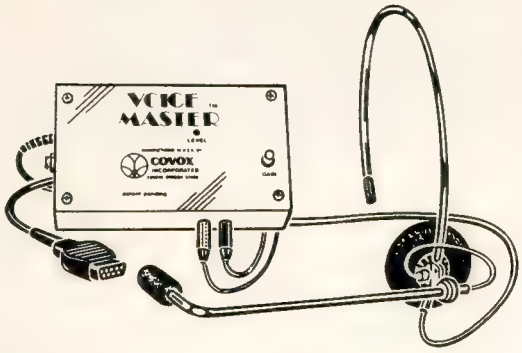

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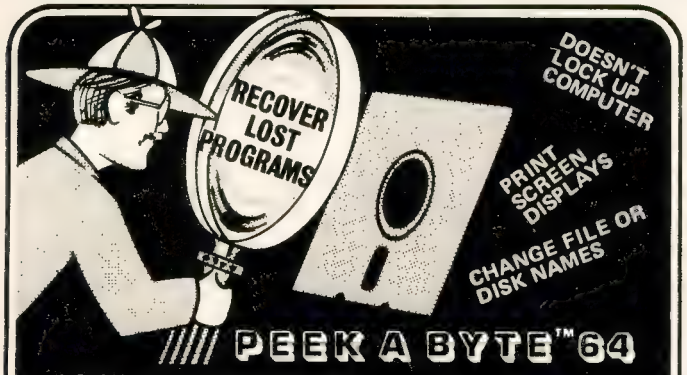

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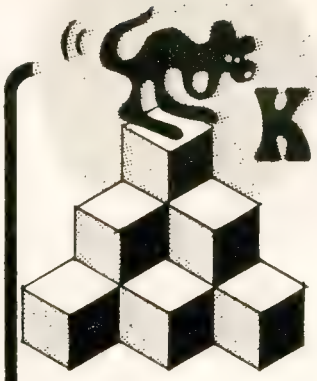

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MONEY BACK GUARANTEE

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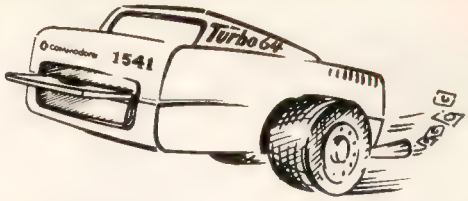

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½ Track Reader-read and select ½ track.

½ Track Formatter-Format a disk with ½ tracks. This is where the next protection schemes are coming from.

Drive Mon-Disk Drive assembler/disassembler. For your 1541.

The Doc-Disk Doctor that reads code under errors.

Sync Maker-Place a sync mark on **any** track out to 41. Also used for protection.

Sync Reader-Check for Sync bits on **any** track out to 41.

Change Drive No.-Changes drive number (7-30).

Disk Logger-Finds starting track, sector; start and end addresses.

Disk Match-Compare any two diskettes. Byte for Byte.

New Wedge-Easier to use DOS wedge.

ID Check-Check ID's on **any** track.

Unscratch-Restore a scratched file.

View RAM-Visual display of the free and used sectors on a diskette.

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Fast Format-Format a disk in just 10 seconds (with verify!).

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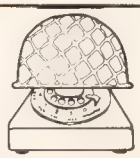

1-**Auto Dial** will automatically dial a set of numbers you choose.
2-**Review Numbers** will review numbers that were answered by a computer.
3-**Save Numbers** will save numbers where a computer answered.
4-**Hardcopy of Numbers** will print out list of numbers where a computer answered.
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7-CYCLE MESSAGES
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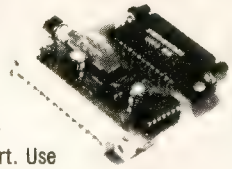

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C-64/VIC-20

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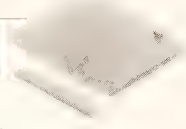

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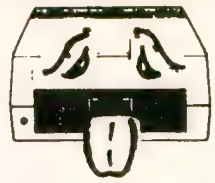

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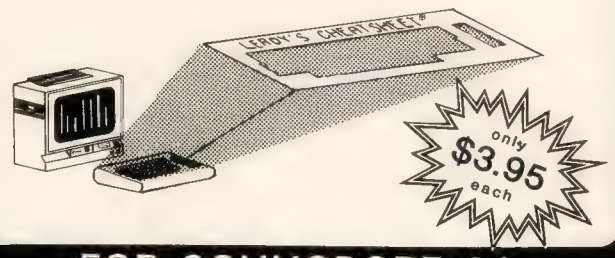

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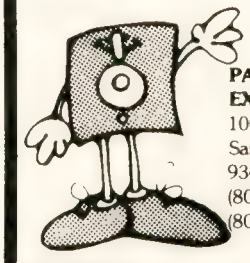

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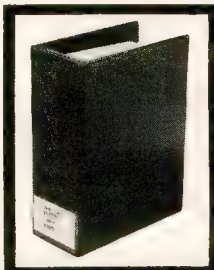

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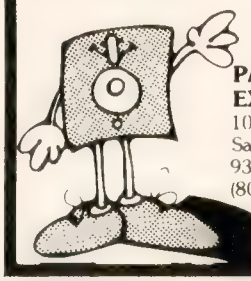

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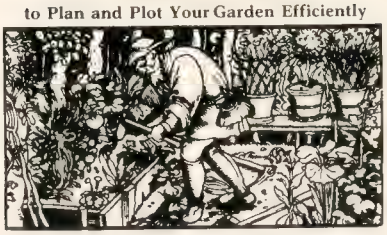

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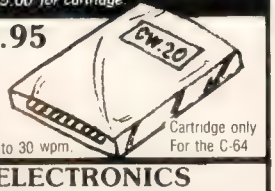

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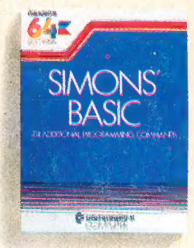

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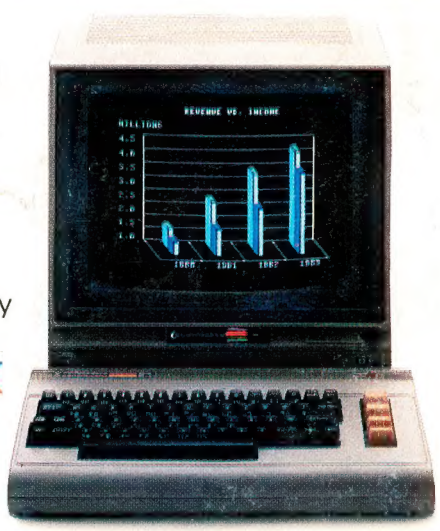

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